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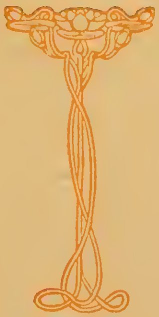

Sixteenth
~~FIFTEENTH~~ ANNUAL MEETING
HELD AT
PITTSBURGH, PENN., July 20, 21, 22
NINETEEN HUNDRED SIXTEEN

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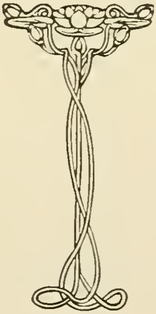

Six
~~FIF~~TEENTH ANNUAL MEETING
HELD AT
PITTSBURGH, PENN., July 20, 21, 22
NINETEEN HUNDRED SIXTEEN

Dates and Places of Meetings of The American Society of Orthodontists

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First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30 and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

Tenth Annual Meeting held at Denver, Colo., July 13, 14 and 15, 1910.

Eleventh Annual Meeting held at Boston, Mass., September 20, 21, 22, 23, 1911.

Twelfth Annual Meeting held at Chicago, Ill., July 1, 2 and 3, 1912.

Thirteenth Annual Meeting held at Chicago, Ill., June 30, July 1, 2, 1913.

Fourteenth Annual Meeting held at Toronto, Canada, July 2 and 3, 1914.

The regular 1915 meeting was abandoned in order not to interfere with the section on Orthodontia of the Panama Pacific Dental Congress, held in San Francisco, Cal., August and September, 1915.

Fifteenth Annual Meeting held at Pittsburgh, Pa., July 20, 21 and 22, 1916

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American Society of Orthodontists

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American Society of Orthodontists.

President's Address.

By F. C. Kemple, D.D.S., New York, N. Y.

It affords me a thrill of genuine pleasure to again greet the members and guests of this Society. With most of you it is like meeting old and close personal friends whose interests and aims are common with my own, and the grasp of whose hands stirs pleasant memories of our early meetings. I feel that this Society is much like one big family whose individual members are all laboring for a common purpose and all pulling together toward a common goal.

It is a matter of personal regret however to many of us that we have just permitted an interval of more than two years to elapse during which time we have held no regular meeting. The value to us, as orthodontists, of these regular annual interchanges of ideas, and the opportunities they offer for a general and generous discussion of the many problems that constantly confront us in daily practice can not be even approximately estimated. They are as essential to the development and growth of orthodontia as wholesome food and drink are to the human body. It must therefore be recognized now as a serious mistake for our members to allow the schedule of any other convention to interfere with the regular annual sessions of this organization.

I am constrained also on this occasion to congratulate this American Society of Orthodontists on its substantial stability as a progressive professional body, and on the steadiness and consistency with which it has pursued the even tenor of its purpose, without regard to or consideration of the determined and persistent efforts that are continually being made

Reprint from Dental Items of Interest

to wreck it. At the time of this fifteenth annual meeting our membership is larger than ever before in the history of the society, and I believe you will all agree, at the close of this session, that the program prepared by our Board of Censors for this occasion will compare favorably with any similar program to which it has been your privilege to listen.

Progress in Orthodontia.

The candor and earnestness with which decided differences of opinion are here discussed are also matters for congratulation. "When men smile and agree, Progress weeps," is the assertion of an eminent surgeon in one of his recent works. But when men disagree as decidedly as they do in this society, and still smile there is every reason why Progress should applaud.

And this leads to the thought that progress—real progress—is seldom made by leaps and bounds, but almost invariably by a steady imperceptable advance, like the movement of the hands of a clock, or the growth of an oak. In medicine and dentistry—including of course the specialty of orthodontia—there must ever occur those occasional spasms caused by the announcement of some new idea that is hailed by enthusiasts as revolutionary to established methods. These predicted revolutions in our methods of practice usually result in nothing more than a nine days' disturbance of ideas. They occupy our attention for a very short time and quietly die, leaving as a heritage to the profession only a memory of another experiment that failed. And progress continues in her snail pace fashion.

New ideas of practice have always received a cordial welcome at the hands of the members of this society; they have ever shown a willingness to test the clinical value of every idea advanced by trying it out in their individual practices, observing and noting its worth, and publishing their opinions broadcast to the dental profession. Our members have no mysteries to be hidden, no secrets to conceal concerning their modes of work. Every dentist and every physician who is interested in any manner in orthodontia is always cordially invited to attend all our meetings and to take part in the discussions. The purpose of this society is to educate its members along the broadest possible lines—for the advancement of the knowledge of orthodontia not alone among ourselves but among the dental profession at large.

Problems in Orthodontia.

The deeper we go into the study and practice of orthodontia the more perplexing are many of the problems that confront us, the more insurmountable seem many of the difficulties that loom in our paths, the more ideals are shattered and the more failures there seem to be to stare us in the face.

A few of our problems are being gradually solved, but in this, as in every other science, with each advance step that is made the field for study and research becomes immeasurably increased. The past decade can confidently be counted as years of remarkable progress in orthodontia, and yet an analysis of the literature covering this period will probably leave us with the conviction that we have scarcely scratched the surface of the subject of our study. One point of real advantage that has been reached through the past fifteen years of study is a complete realization of our profound ignorance of many of the questions upon which, fifteen years ago, we felt we were fully informed. Let us hope then that this is the beginning of wisdom.

Importance of Records.

One of the weak points in the fabric of orthodontia to-day is the scarcity and incompleteness of our records of both treated and untreated cases. And I am more than pleased to have on the program of this meeting a paper by one of our veteran members on the subject, "The Records of an Orthodontist." To my mind this is one of the most important subjects with which we have to deal, because of the fact that in the final analysis these records must form the very foundation of our knowledge of malocclusion. One of the questions frequently asked by a parent who is considering the advisability of having orthodontic treatment for his child is: "What is going to happen if this work is not done, if the teeth are left just as they are?" In the large proportion of cases that are presented for treatment, how many of us can answer that question intelligently and with any degree of assurance?

To answer such questions intelligently requires a careful and thorough study of the complete records of a large number of untreated cases, and at the present time there are very, very few such records to be had, and while I recognize the difficulty of obtaining complete records of untreated cases, nevertheless I earnestly urge our members to secure as many of these as possible. We must have them if we hope to learn what is likely to happen in cases that are left untreated. And we must know what is likely to happen in cases that are left untreated if we hope to advise our patients intelligently.

There is small doubt in my mind but that a careful study of even fifty or one hundred sets of models of untreated cases, the first taken, say, at the age of from five to seven years, and the last at from twelve to fourteen years of age, would greatly modify the present practice of early treatment.

Changes in Glenoid Fossa.

Another point that should be thoroughly studied and the observations carefully recorded and published by the members of this Society is the change that takes place in the glenoid fossa as indicated by the path of the condyle in both treated and untreated cases of malocclusion. We are probably all confirmed in the opinion that a very marked change takes place in this region in most of our cases during the period of treatment, but with our present knowledge, or rather our lack of knowledge, we can only blindly guess or surmise what this possible change may be.

A collection of carefully made tracings of the path of the condyle, at the beginning, and at intervals during the course of treatment, and again a final tracing a year or two after the completion of treatment, might throw considerable light on what is now rather a dark subject.

Dr. Milton T. Watson records the incident of one of his little patients, who was being treated for a Class 3 malocclusion, jumping out of bed at night and running to her mother with the joyful announcement that "her jaw had just gone back." It would be not only interesting, but instructive, if we could know just what took place when this jaw "went back."

In many Class II cases excessively deep overbites in the incisal regions have apparently corrected themselves during the shifting of the mesio-distal relation of the molars and bicuspids without any effort whatever on the part of the operator to control the overbite. In these cases also it would be instructive to know what change has taken place in the region of the glenoid fossa.

I would suggest therefore that our members equip themselves with the means of studying the condyle path and that they make these tracings a part of the records of their cases.

Metallic Bands.

Almost since the beginning of orthodontia it has been a customary practice of all operators to place metallic bands on young teeth that are just erupting and to leave these bands cemented to the teeth for a period of one, two or even three years, with apparently no thought of the possible effect they have on the physiological and histological processes going on within the structure of the teeth so banded. It is rather unreasonable to believe that a young growing tooth can be incased in such an artificial covering for so prolonged a period without there being produced some physiological disturbance within the body of the tooth which may considerably alter its histological structure.

To find the answer to this question also offers an interesting bit of research for those of our members who are scientifically inclined.

Through the efforts of a number of the members of this Society, and the co-operation of several metallurgists, the question of the best materials to be used in the construction of orthodontic appliances has been fairly satisfactorily answered. This, together with the fact that this Society never occupied so strong a position in its history as it does at the present time, inspires me to recommend that committees be appointed to assist in the study of such questions as the changes in the region of the glenoid fossa, and also on the possible effects that cemented bands may produce on the internal structure of the tooth and many others of a similar nature.

I am earnestly interested in seeing this Society devote its energies to such lines of research as may lead to tangible, practical solutions of the problems being investigated and that may culminate in the form of positive knowledge.

I cannot close this address without expressing to the members of this Society my sincere appreciation of the honor they have conferred upon me by choosing me as their presiding officer for this session, and to acknowledge my grateful thanks to the Board of Censors for the splendid program which they have prepared for this meeting, and to the Secretary-Treasurer and the Vice-President for their willing co-operation in making this meeting a success.

Discussion of President's Address.

Dr. F. M. Casto. Mr. President and Members of the Society: I feel that I can agree with almost everything the President has proposed. But I am sure you all realize that some of the things he has outlined as desirable in regard to histories of cases, the following up of untreated cases, etc., would be very difficult to accomplish. The very character of the tissues with which we have to work and the length of time these cases must be cared for make it very difficult. He has stated that perhaps this might be placed in the hands of committees to work out some solution of the proposition, and I think it may be possible that we might work in connection with the National Research Institute, and perhaps receive from the Institute some of the "grants" they are now proposing to make. This might develop something. Probably if this work could be done in some of the institutions, educational and otherwise, where the children could be kept under fairly close observation a considerable length of time, that, too, would be worth while.

Dr. W. B. Ellis. I wish I might disagree with some of President Kemple's remarks, and thus dry the tears of progress, for you notice he said: "When men agree and smile, progress weeps." But I am afraid he will be disappointed in that this morning, for his address was beyond criticism.

It is, as he said, too long a time since our last meeting. It would be of profit and pleasure if we met even more frequently than yearly, say twice a year. Might we not have this as our annual meeting, and have another in six months, this second meeting to consist of sectional meetings in different parts of the country? This would give those in each section increased opportunity for interchange of ideas and better fellowship. These second meetings could be as formal or informal as the members in these sections desired.

Further studies of the change in the glenoid fossa in normal growth and during orthodontic treatment would throw light on treatment of all classes of cases. However, I am of the opinion that forces used in orthodontia have very little permanent effect upon the relation of the condyle to the glenoid fossa, unless it be in those cases being treated for unilateral or bilateral luxation.

President Kemple's query of possible physiological or histological changes in a tooth under a cemented band is interesting. Hitherto I had only concerned myself about possible physical changes, having considered any other changes very improbable.

Yes, the study of normal and abnormal developmental changes of cases not under orthodontic care would be of great value. These studies show us just what Nature, unaided, will and will not do. We can readily recognize when normal growth is taking place. In those where it is not, there is, of course, some predisposing factor which is interfering with normal development. If we can only recognize these factors, be it lack of normal function (exercise), which is quite frequently the case, or some pathological disturbance of the naso-pharynx, by its removal Nature will be allowed to proceed with her wonderful work and develop unaided a normal denture. If we are not sure of removing these factors and restoring normal function and a natural environment, orthodontic interference is our only alternative. I believe that our efforts should be more of an aid or stimulation to normal development than an attempt to actually take its place. By this I mean our appliances to best simulate natural growth must not hold the teeth *too* firmly, but should be so constructed as to give force only where indicated, with possible rest periods, so allowing for the full force of mastication to be taken up by the teeth and the supporting tissues and not by the appliance. This gives a healthy, natural reaction to these tissues. That old axiom holds good even here, "The use of an organ determines its strength." That leads me to express the thought that Nature has constructed an instrument unaided that is a better orthodontic appliance than man can ever fashion. Given half a chance she will do her own work and most of the orthodontist's.

When we can read her better she will with but little help do the developmental work without us. But with the artificial over-civilized environment in which most of our patients live, this time is likely still far in the future.

However, I believe there is a large field as a medical consultant for the orthodontist. There is much sound advice and counsel that can be given to mothers and their medical attendants by orthodontists that will aid in the prevention of the development of malocclusion.

I have in mind advice as to the importance of breast feeding in infancy, diet, habits, prophylaxis, and most important of all, normal functional activity; that is, mastication and plenty of it.

Dr. B. E. Lischer. I am not prepared at this time to discuss the questions presented by the President, and he took me by surprise in referring to the paper I am to read at this meeting. This is hardly an appropriate time for me to discuss the question of records, because I do not want to repeat myself.

I am glad to note, however, that he has met with difficulties in practice—in fact, every one of us has—and it strengthens an opinion of mine I have long held, viz., *the true pathology of oral deformities has not been worked out as it should be.* In a series of papers entitled "Face Facts" (see current volume of *International Journal of Orthodontia*), I hope to present an adequate number of facts this autumn and winter which will widen our horizon in this direction. Not that I feel sufficiently competent to present this difficult subject in an exhaustive manner, but I hope to be so convincing that few will doubt that it is the way by which we must approach the matter.

I am thoroughly convinced that not a few of our difficulties in practice are due to a faulty diagnosis, and it is a very serious mistake to proceed on the theory that all cases of oral deformity can be classified into three groups, purely on a basis of the occlusal relations of the teeth. But, as I have already intimated, this is a topic of such great and fundamental importance that it is hardly proper to discuss it in detail at this time.

Dr. Monroe. I am especially interested in the President's address, and particularly in the matter of periods of rest from orthodontic appliances and the education of the mother. It has been my lot to run across many mothers who knew little as to the care of the children's mouths while they were growing, and as the education of the child should commence many months before its birth, it seems to me that Dr. Ellis' remarks as to the teaching of the mothers in these matters are very appropriate at this time, as I do not know anything that has more influence on the malformation of the arches than the effects of habit: biting the nails, sucking the tongue, biting the lips, and all those evils that children are so often addicted to. These things give us lots of trouble, even after our cases are corrected of malocclusion. I thank Dr. Ellis for mentioning that subject, and Dr. Kemple for mentioning the rest period, as I have found much benefit in taking the appliances entirely off and allowing the children to go without anything after I have gone a certain distance with the work. Let them rest awhile, and then go at it again.

Dr. Burt Abell. It seems to me that we must come to the point of giving the teeth and tissues a rest. We have not done that enough. We have been overdoing the treatment. Give the teeth a rest and let them go untrammelled for awhile, and then put the bands back and go to work.

Dr. C. A. Hawley. I do not know that I can add any more to the paper. I am always pleased with anything Dr. Kemple writes. There is undoubtedly danger of injury to teeth from keeping them banded for long periods of time. I do not know why it is. Even though a band is perfectly fitted and cemented, there appears to be a susceptibility to decay.

The other problems mentioned need further investigation It occurs to me it would be impracticable to appoint a committee to investigate any such problems. They are naturally taken up by men especially interested and fitted along these lines. However, I think the Board of Censors could direct such an inquiry, or indicate some men to be placed on the next program to consider this matter. All of these subjects Dr. Kemple has mentioned are worthy of further investigation.

Dr. Kemple. I do not believe I can add anything to the paper or discussion, but I do feel very earnestly that the science of orthodontia is woefully lacking in complete records of both treated and untreated cases of malocclusion. We have been too much inclined to accept and quote opinions and beliefs as facts. What we need is recorded data to take the place of opinions. A collection of models and records of untreated cases is just as important as models and records of treated cases. When parents ask, "What is likely to happen if our child's teeth are not straightened?" we ought to be able to answer them intelligently and with some assurance, but until we have a large collection of models of untreated cases we cannot give such an answer.

We have all heard of the "comforters" that are used by so many babies, condemned in the strongest terms possible, but I do not know of a single record of a single case that goes to prove that they are justly condemned. I do not know whether they are good, bad or indifferent, so far as their use may affect the development of the jaws, and I do not know of any person who *really does know.*

In referring to cemented bands on young teeth I had not thought of caries, but of the possible effect they may produce on the histological structure of the tooth. This is a question that could be readily answered by a little experimenting on the teeth of young dogs or monkeys.

As orthodontists we should not go on jumping at conclusions and accepting opinions that are not supported by scientific or clinical evidence, but should earnestly search for facts in the hope that their accumulation may solve some of the problems of the cause and of the treatment of malocclusion. I should like to see this society take up the study of some of these questions in co-operation with the Institute for Dental Research, or with the Forsyth Institute, or with any dental clinic that may be able to aid in such study.

I thank you for your interest and your patience.

Important Prenatal Factors That Influence the Development of the Facial Area, and Cause Malrelation of Dental Arches at Birth.

By Dr. B. W. Weinberger, New York, N. Y.

Read before the American Society of Orthodontists at Pittsburgh, July, 1916.

Among scientists for ages there has existed a singular interest in the problems of how we came to be what we are, and why certain conditions exist as they certainly do. This is not remarkable, for we are an integral part of the series of forms and circumstances which surround us, the product of an orderly series of changes which has left its record in the gradually ascending chain of organic forms.

In the search for those etiological factors that determine the future organ or structure, we must begin at the earliest period of its existence and review the stages of ontogenetic development.

"A solution of any problem has largely been sought by philosophical considerations. The result of this has been the creation of almost as many theories as there are possible experiences, and decision is not attainable because there are no criteria for evaluating the relative worth of the individual theories. This method of solving the problem reaches the limit of its usefulness when all the conceivable possibilities have been considered. At its best it is a mere statement of the case and each individual will take from it that part which his natural endowment enables him to put into it." McClung (1).

We must, therefore, as in other branches of sciences, utilize the summed-up experiences of the stages of the evolutionary process as a means for further advancement.

Angle states in his "*Malocclusion of the Teeth*" (2): "A long period of time—twenty years or more—is required by Nature to complete the building of the human denture, and during this time not only are all the beautiful and wonderful structures of the teeth and the rest of the tissues of which the dental apparatus is composed being unfolded in development, but all the other organs and structures of the body are likewise passing through the mysteries and marvels of growth; all, under normal conditions, proceed continuously and harmoniously toward the first complete development of a normal, if not a perfect whole, that when completed each may best perform its function—its allotted part in the work of the whole." "All parts of anatomy are liable to abnormalities in development. . . . The different parts or combinations of parts entering into the performance of these various functions and acts are so intimately associated that even slight inharmony in the growth and development of any one may ultimately involve the whole apparatus, interfering with the normal functions of all, even producing repulsive deformities, for the influence of these parts on each other is always continuous and progressive—toward the maintenance of harmony and the normal, if normal, and toward the increase of inharmony and the abnormal, if abnormal."

Factors Affecting Early Malrelation of the Arches.

However, we have malrelation of the dental arches at a much earlier period than has previously been recorded, and some of these abnormal relations are of prenatal origin.

The etiology of malformation depends either upon internal causes or upon the action of external influences. Thus etiological conditions consequently depend upon one of the following three causes:

First. Direct family heredity, not only of the parents, but of the ancestors as well.

Second. Pathological. Not only disease, but all that pertains to it. Results are marked by irregularities.

Third. Mechanical. Neither healthy nor pathological.

Malformations.

"A malformation is generally defined as a condition which may be attributed to more or less important deviations from the normal course of intra-uterine development." R. Birnbaum (3). Schwalbe's (4) definition is perhaps a better one. He defines a malformation as an alteration occurring during fœtal development—*e. g.*, a congenital alteration of one or more organs or systems of organs, or of the whole body, which does not come within the range of variation of the species.

Nearly all malformations (embryonic and fœtal) originate in the first six weeks of intra-uterine life, or the embryonic period, and "*when the malformed embryo becomes a fœtus, it carries whatever malformations it has into the fœtal period, and is born with same.*" (5) Therefore, congenital malformation is not always the product of late, but of early uterine pathology.

Heredity.

When there has been a disturbance of development such as has occurred in the ancestors of an individual, we find such malformation the result of inheritance, for example, supernumerary fingers or toes, teeth, harelip, etc.

Heredity thus bears not only on the features, but on the physical characteristic, the build, weight, tint of the skin, the eyes, hair, etc., *i. e.*, all that constitutes individuality, as shown by E. Apert (6): "Peculiarities persist in successive generations only when they exist at the same time in the paternal and maternal ancestors; in the inverse case they rapidly disappear."

Considerable has been written concerning the influence of heredity in orthodontia, as shown by Dewey (7), Talbot (8), Hus (9), and others, but the theories have never been proven. "Since the chromatin is the characteristic of the nucleus, and since the spermatozoon in some cases consists almost exclusively of chromatin, it is probable, as maintained by Minot (10), that chromatin is the essential factor in the function of heredity." "The child is like the parent because its organization is regulated by not merely similar, but by some of the same chromatin as that of the parent."

In all cases development begins with the fertilized egg which contains none of the structures of the developed individual, though it may exhibit the polarity and symmetry of the adult and may contain specific kinds of protoplasm which will give rise to specific tissue or organs of the adult. The variations which are a normal inheritance of the race, and include such forms as individuals with six toes or fingers, must be distinguished from the abnormalities of structure due to unfavorable environment either within or without the body. In the main, the shapes of the bones and joints may be inherited, according to Bardeen (11), but to some slight extent both bones and joints are moulded by the individual; abnormal muscular or lack of muscular stress both give rise to bones and joints in abnormal form.

Variations in the bones of the adult human skeleton are frequent, as shown by Rosenberg (12), Mall (13), Thilenius (14), Ballantyne (15), and others, who ascribe some of these variations to the chance persistence of transitory conditions normally present in the embryonic or fœtal skeleton and supposedly of phylogenetic importance. The studies of these men have shown that the skeleton of the embryo is subject to fluctuating variations similar to those of the adult.

Factors Which Influence Development.

However, certain factors must be born in mind as influencing the further growth and development of the individual. The form of the skeleton as a whole and of the individual bones which compose it may depend partly upon heredity, partly upon pathological, and partly upon the mechanical or chemical influence to which it is subject during growth.

During development the skeleton is markedly influenced by internal chemical conditions affecting growth or general nutrition of the body, and in some cases seems to be the part primarily affected.

In order that the development of the face and mouth, and the prenatal factors that govern this area may be understood intelligently, it is best to review the development of the human form.

Considerable has been written concerning the germ cell period, therefore it will hardly be necessary to take up in detail this important stage.

The period of human gestation has, according to Ballantyne (15), arbitrarily been divided into six periods. (1) The pre-embryonic, impregnation or stage of zygote. (2) The embryonic, extending from the second week to the end of the eighth, during which the zygote begins to assume definite human characteristics. It is during this period that the first rudiments of the embryo is begun, and the lines along which future growth takes place are laid down. (3) There is a short period of two weeks, known as the neofœtal, during which the placental circulation is being established. (Organogenesis.) (4) Immediately following this is the period occupying the longest part of pregnancy when evolution and growth takes place. Then comes the period of birth, (5) neonatal, or period of adaption, and (6) postnatal.

The chief results of physiological activity in the embryo are the formation of parts and organs, and this leads to normal formations; when pathological activity exists, malformation is the result.

The first relatively satisfactory synopsis of the development of the external form of the human body was that of His (16), in "*Anatomie Menschlechen Embryonen,*" and in the *Normentafel* published with it, and shown in Fig. 1, a series of human embryos from the second week to the third month showing in what a short space of time the embryo develops. The earliest known embryos are flat, shield-like plates, which rest upon the yolk sac. Fig. 2 (a) At a certain stage a primitive streak extends throughout the entire length of the shield. In the front of the primitive streak the embryo is formed and it grows at the expense of the streak, which retrogresses in a cranio-caudal direction. Fig. 2 (b) (c) The streak is thus converted into a growth zone, which may be termed at first the trunk bud and later the tail bud. The caudal end during the modification of the primitive streak becomes bent ventrally and begins to lie on the ventral surface. Fig. 2 (d) This bending process is associated with the construction of the embryo from the yolk sac, cranially, and caudally; from the right and the left the boundary grooves cut inwards and soon convert the yolk sac into a stalked vesicle; meanwhile the dorsal portion of the embryo grows more rapidly than the ventral, a condition caused by the accelerated growth of the medullary anlage. Before the medullary plate is converted into a tube the brain with its principle subdivisions becomes distinct at the anterior end, and the optic pits are formed. The rapid growth of the brain portion produces a bending down of the cranial portion and a more caudal nape bend. Fig. 2 (e).

The entire embryo soon becomes curved on account of the much greater growth of the dorsal surface, and coils itself in a spiral. (Fig. 2-f-l,) Fig. 3. While these developmental processes are taking place there has formed from the tail bud a small but unquestionable external tail. In these stages the head region still predominates to an extraordinary degree. The extensive coiling toward the ventral surface is followed by a very gradual uncoiling. Fig. 4 (q-z) First the trunk straightens out and the nape bend slowly becomes obliterated. These processes are accompanied by a rapid growth of the ventrally situated organs, especially of the heart. With the straightening out of the nape bend opportunity is afforded for the formation of the neck.

Growth of Foetus in Successive Monthly Stages.

Having traced the growth of embryonic structures in a general way, let us outline the successive changes that have taken place in them from month to month.

In the first week the embryo is a semi-transparent, shapeless mass, in which no regular definite structure can be discovered. All that can be made out is the surrounding amnion and the pedicle of the umbilical vesicle leading into the abdominal cavity. At the middle of the first month the extremities are visible in the form of minute projections from the main portion of the body. The first of the branchial arches make their first appearance during the third week (Fig. 1) (e), the first forming the mandible, the second the hyoid, but there are no indications of the eyes or ears. A very noticeable change in the external appearance of the embryo is visible, the presence of limb-buds.

(Fig. 1 (g) (23rd day.) Three or four branchial arches can be detected, and have begun to be transformed into more permanent bodies. Toward the end of the fourth week the sinus præcervicalis is well marked and the fourth branchial lies deeply in it and largely under cover of the third arch: the third arch also is within the sinus.

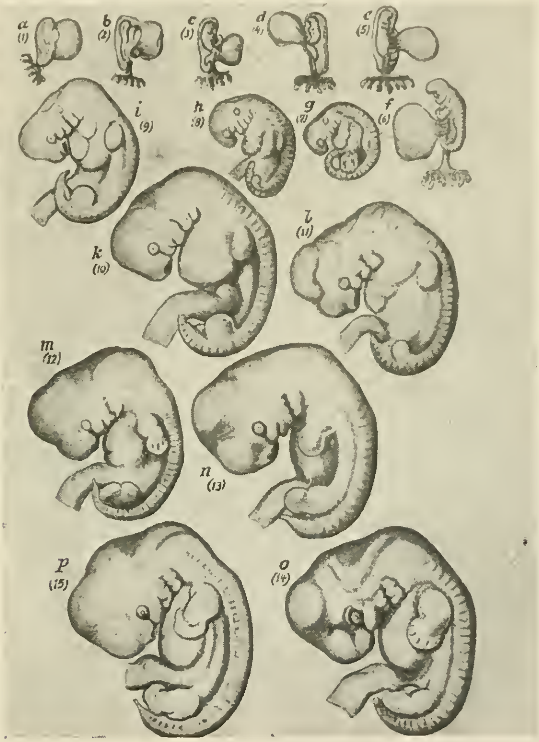


Fig. 1. Development of the Human Embryo (His's Normentafel).

In the second month the head can easily be seen with an eye on either side looking like a black bead fastened to it. The vertebræ are forming, the heart is also now in evidence with one auricle and one ventricle, and the pulmonary artery and aorta arising from the inferior maxillary bones. From the dorsal or attached end of the first branchial or mandibular arch a projection can be seen arising; this is the superior maxillary process, and it can be recognized both in the beginning and toward the end of the fourth week. During this week another change in the facial region is noted, namely, the appearance of the nose. Toward the end of the fifth week the head, as seen from the side, has an area about equal to that of the rest of the body.

The sixth week closes the period of construction of the embryo and enters the period of growth; histological and physiological differentiation. The facial region becomes more face-like. Looking more closely at the face, the union of the maxillary process with the lateral nasal and frontal nasal process has taken place.

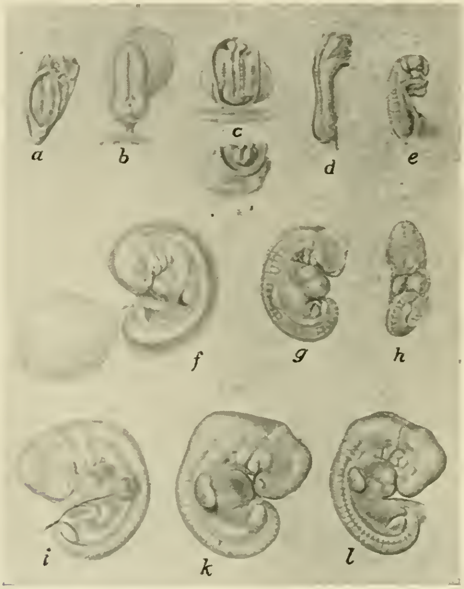


Fig. 2. Showing the early stages of Embryonic Development (Kiebel and Elze Normentafel).

In the third month the interventricular septum has formed in the heart, dividing it into two auricles and two ventricles. The forearm with finger-like processes have developed. The abdominal cavity has become a closed space, the alimentary canal has begun to be formed. The head and eyes are much larger than formerly and the mouth and nasal cavities are separated from one another.

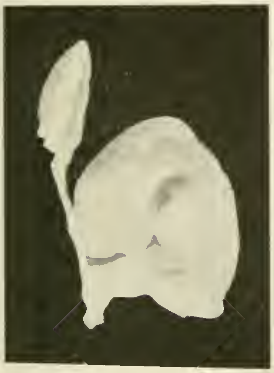
During the fourth month the head, with its covering of hair, is constantly growing larger. The inclosed brain begins to show a convoluted appearance. The muscles are developed enough to give some movements to the limbs, and centres of ossification can be seen in the occipital and frontal bones and the mastoid processes of the temporal bones.

In the fifth month the head becomes very large, and makes up from one-quarter to one-fourth of the whole length of the fœtus. The nails are formed.

It is during the sixth month that the fœtus weighs a full pound.

In the course of the seventh month the fœtus has gained from two to three pounds in weight. It is from twelve to fifteen inches long. Many of the mature structures of the skin are fully formed.

During the eighth and ninth months a general increase in size and weight results.



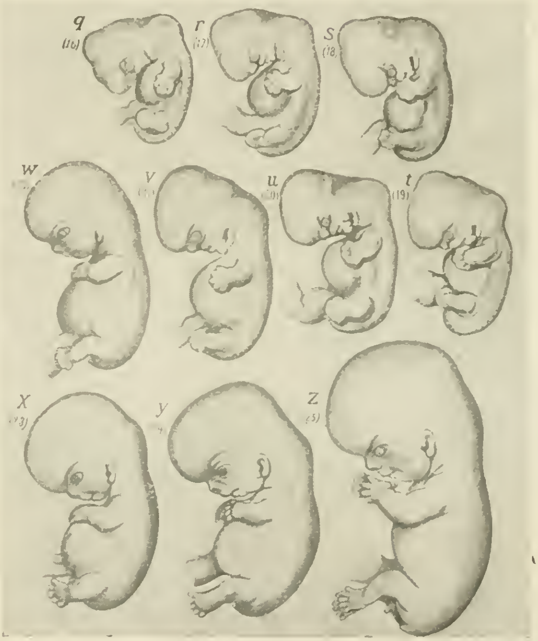


Fig. 3. Showing the extreme coiling of the Human Embryo (Army Medical Museum).

Fig. 4. Development of the Human Embryo cont'd. Gradual uncoiling.

Development of the Face.

The position of the face is determined by the head bend, as the medullary tube enlarges to form the brain, the end of the head bends over, carrying the oral plate over on the ventral side of the projecting head, as the oral plate occupies the entire space between the forebrain and heart, there being no oral cavity at first. The changes which develop the oral cavity are the growth of the brain and the pericardial cavity, due to both expanding ventrally leaving a space, the mouth cavity. At first the fossa between the head and heart is shallow and without connection with the entodermal canal.

In the latter part of the first week the human embryo resembles the fish, possessing the basis of a branchial arch. The olfactory organ is represented by a pair of pits or depressions, which have no communication with the mouth. Toward the end of the second week these have united to form the facial part of the head. Of the five, one, the nasal, or fronto-nasal, composed of symmetrical right and left halves, is median and projects beneath the forebrain; the others are lateral, two on each side, the mandibular and maxillary. The cavity which these five processes surround is the stomodæum. The first branchial arch becomes divided into two portions; one of these, the maxillary process, is destined to give rise to the upper lip and face region. The other, the mandibular process, is destined to give rise to the lower jaw, lower lip and chin region, and two of the auditory ossicles. The angle between the two processes corresponds to the angle of the mouth and the cavity enclosed is the beginning of the oral and nasal cavity.

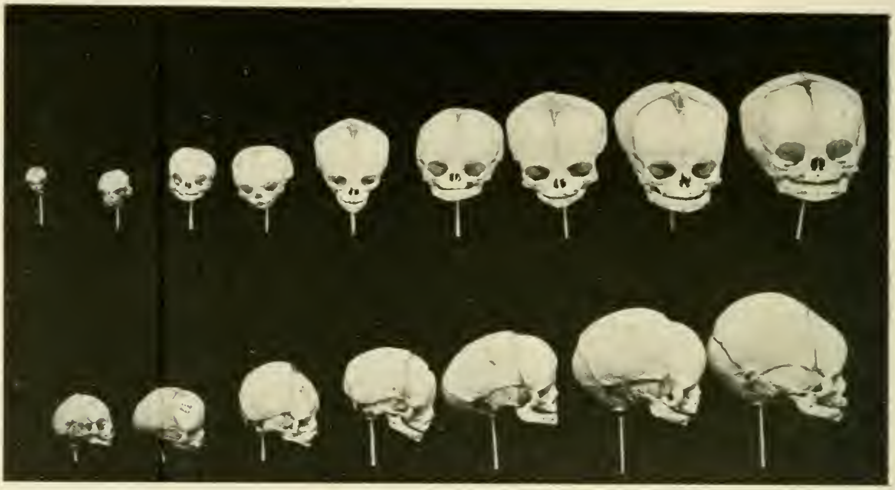


Fig. 5. Series of Embryonic Skulls the beginning of the third month to the ninth month. Front and side views. Showing gradual development of skull. First of third month. 2. End of third month, beginning and end of fourth month. Fifth, sixth, seventh, eighth, ninth months.

Fig 5 shows the rapid development in size of the face from the beginning of the third month until birth. The relative small size of the maxilla is a cause of the small dimensions of the fœtal face, but at birth the maxillary sinus, which is only a slight depression on the medial surface, extends laterally into the maxilla and gradually enlarges until dentition is complete. As this maxillary sinus increases in size, the alveolar process develops, and with the development of the teeth brings about the growth of the maxilla and the corresponding parts of the face.

In the embryo the face and the neck are formed in the following manner: On either side symmetrical processes, the so-called visceral arches which lie between the visceral or branchial clefts, grows forward and unites with one another in the median line. The neck develops from the three lowest visceral arches which unite with one another anteriorly. In the development of the upper jaw and the soft parts covering it, the cheeks and the tissues of the upper lips—the process takes place rather differently. As the horizontal processes growing toward one another,

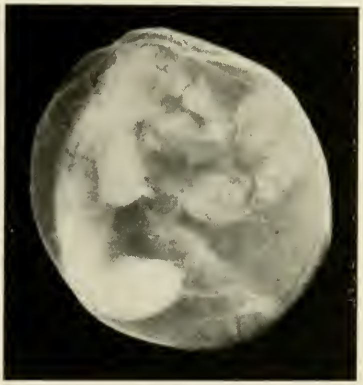


Fig. 6. Showing the Embryo envolved within the amnion. (Army Medical Museum, Washington).

the so-called maxillary processes unite like the upper branchial processes of the neck; at the back in the soft palate and the palate bones, a horizontal plate grows inward from the maxillary process and fuses with the plate of the opposite side to form the hard palate, while the soft palate is formed by a fold arising as a prolongation backwards of each horizontal plate into the pharynx, while in front a vertical process growing down from the anterior end of the skull inserts itself between them, the fronto-nasal process.

This frontal process is divided by two clefts, the nasal grooves into three portions—a median and two lateral.

Malformation of the Face.

From the median portion is formed later the philtrum of the upper lip, the intermaxillary bones, and the vomer; from the lateral portions the lateral part of the upper lip and cheek on either side, with the corresponding underlying bones—the lateral segments of the upper jaw. From the first branchial arch, the mandibular process, develops the lower jaw and the aperture of the mouth. By the union of these parts with one another, and in the median line, the anterior portion of the face is formed. If the union does not take place, abnormal fissures result. One of the nasal grooves most frequently remains open; or the fissure is situated in the region where, normally, the philtrum of the upper lip, the inter-maxillary bone and the vomer on the one hand, and the lateral portion of the upper lip and cheek, the upper jaw and gums on the other hand should unite with one another. In this way lateral hare-lip and cleft palate occur. If the two maxillary processes do not unite posteriorly, then a median cleft of the soft palate occurs; and in this case, of the hard palate, as well, as normally, these processes should unite in the middle line, as the lower branchial arches do. If the union between the process of the upper jaw and the lateral part of the frontal process does not occur, a cleft remains between the corresponding parts, namely, between the lateral part of the cheek and the outer part of the lip.

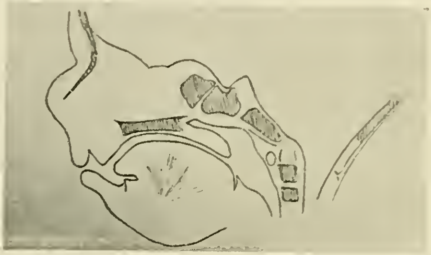


Fig. 7. Mesial section through base of cranium and face of normal foetus (from Kaufmann).

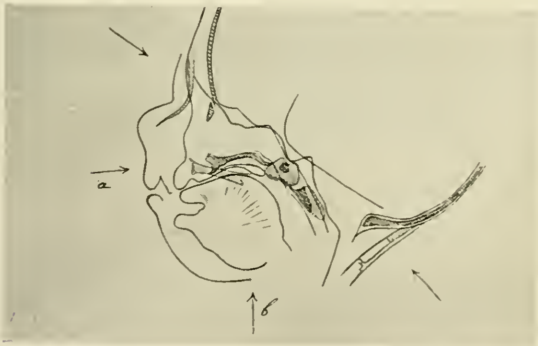


Fig. 8. Kaufmann's foetus VI laid together with the normal Fig. 7. Pressure during foetal life has acted in the direction of the arrows a & b. Light lines are the normal. The hard palate is displaced backwards and bent.

The causes of these fissures are not well understood. The malformation is either primary and hereditary, or secondary and caused by adhesions of the amnion, or by the interposition of portions of tissue within the fœtal clefts.

If the development of the processes of the lower jaw, derived from the first branchial arch, is defective, then incomplete formation or complete absence of the low jaw occurs.

In families subject to cleft palate it has been shown that the lateral incisor is often peg shaped or even absent, and that there is a tendency toward supernumeraries. (17.)

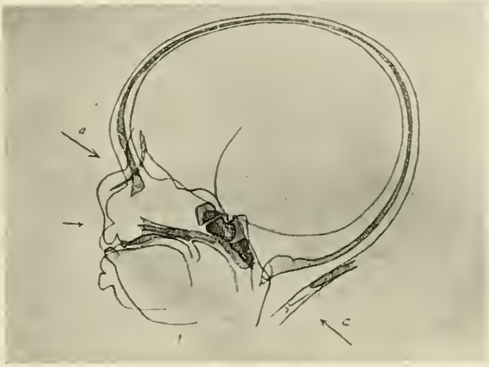


Fig. 9. Basis cranium of Kaufmann's foetus I laid together with the normal (light lines). Pressure here is in the direction of the arrows a & c. Mandible pushed forward.

We can thus see that the evolution of the face must depend first upon the enlargement and fusions of the oral and nasal cavities; second, upon the partial separation of those cavities, leaving the posterior nares open; third, upon the growth and specialization of the facial region of which the development and elongation of the maxilla and mandible is the most conspicuous indication. While this is occurring there is a modification of the position of the face in relation to the brain, cranium and heart. As the oral region develops the extensive coiling of the embryo begins to straighten out and the heart's position descends.

The change in the heart's position leaves the greater part of the pharynx free to be differentiated in intimate association with the oral region, and this change also separates the mouth and the heart.

This position plays a most important rôle in the development of the branchial arches, as already shown the face lying so close upon the heart prominence, that the development of the arches may be retarded and growth arrested. The growth of the jaw increases the separation of the mouth from the heart.

Another fact worthy of note is, that even when the mouth is tightly closed the alveolar processes and gums do not come in contact; thus provision exists at birth for a considerable development of process and teeth before the teeth of the two arches come into contact. At birth there is no eminentia articularis nor glenoid fossa.

The mandible is small, owing to its symphysis not being fully ossified and the angles being obtuse, gradually change, and with the development of the teeth during youth brings it to adult form and size.

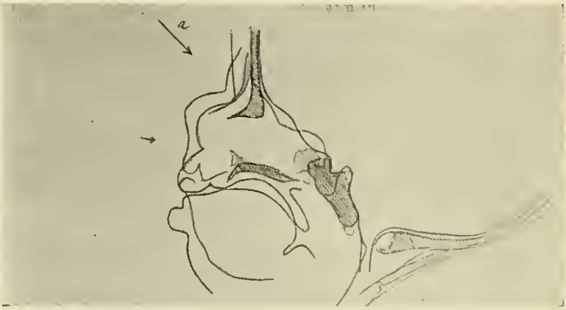


Fig. 10. Shows a similar condition to fig. 9.

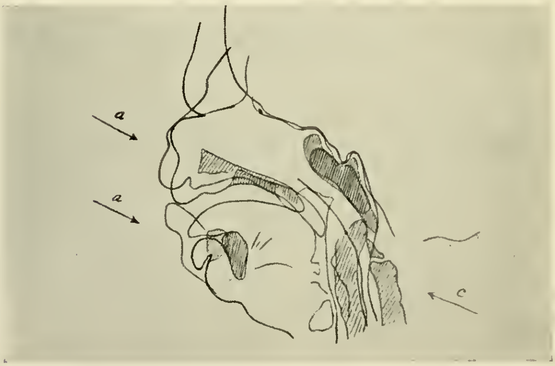


Fig. 11. Outline of a frozen section of a normal and abnormal foetal skull. Pressure here has been in the direction of the arrows a & c. The base of the cranium is shortened, and the mandible displaced backwards, as well as the hard palate. The noso-pharynx is narrowed. The sagittal dimensions, of the mouth and nose of all, are notably reduced.

The head is rarely normal in shape immediately after birth; within a week, however, the bones adjust or mould themselves and the head becomes round or oval.

Pituitary Body.

The growth of the internal bones of the cranium and face depends primarily upon the development or lack of development of the sphenoid, for the bones of the face are built around it. Any peculiarity of the sphenoidal rostrum must necessarily leave an impression on the ultimate development of the facial area. Ballantyne (18) has stated that an enlargement of this bone will cause the mandible to project forward, causing the maxilla to become V-shaped and pointed, but that is questionable.

The pituitary body is a structure of very problematical significance. It arises in all vertebrates as an evagination of the ectoderm near the dorsal border of the oral palate, but is separated from the palate by a fold of the ectoderm. The enlargement and fusion of the oral and nasal cavities involves a change of position of the hypophysis, the organ developing as an outgrowth of the oral chamber.

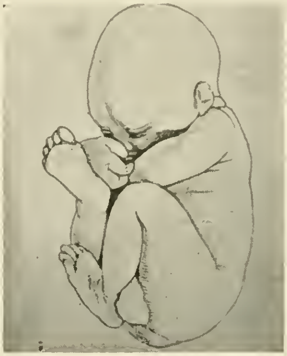


Fig. 12. Peculiar positions foetus assumes, showing position of the limbs.

The pituitary body exercises a curious influence on the growth of certain parts, especially on the face and limbs, in both men and animals. Hypertrophy of the organ is associated with osseous growth and hypertrophy, leading to giantism or acromegaly. A diminution of its function is followed by a decrease in growth. Thus interest in the pituitary body is two-fold, and two questions arise in connection with the disturbance in its development:

First. What will be the result of this disturbance prior to birth?

Second. Does it have a direct bearing on the maxilla and mandible, and their relation to one another?

Acromegaly, from what we now know, is probably an affection of mature years, and not one at birth nor in youth, as it "presents itself only when the diaphyso-epiphyseal cartilages have disappeared." In acromegaly, therefore, only an interstitial growth is possible, and this is wanting altogether in adult life. It is probable that bones like the mandible, whose normal development takes place exclusive of interstitial growth, may increase more in size than the long bones, whose normal growth is affected by apposition for a considerable part.

In acromegaly the protruding parts of the body, as the jaws, nose, hands or feet, seem to be the parts most affected. The pituitary gland stimulates the growth of all parts equally, therefore hyperpituitarism causes a "giantism which affects the whole skeleton equally, being of a purely interstitial nature in the adult." If it is true that it affects the skeleton as a whole in no less a degree than the peripheral, the bones formed in membrane no less than those formed in cartilage, it is hardly likely to cause an enlargement of the mandible alone, nor to affect the relation of the dental arches prior to or soon after birth.

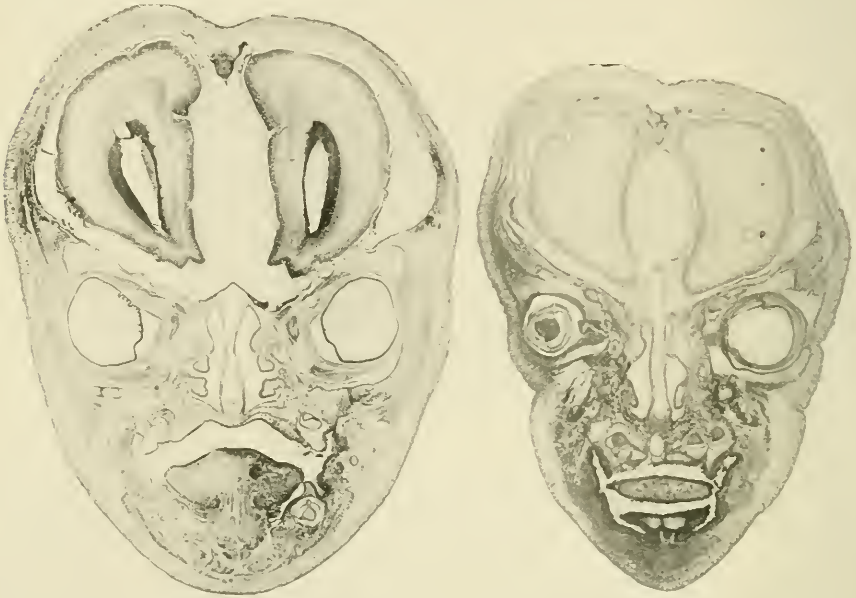


Fig. 13. Coronal section of heads of foetus, micro-photographs. a. Showing well defined outline of the head. Large nasal cavity. b. Another specimen, cut slightly forward. Irregular outline of head. Left nasal cavity blocked by the turbinates showing that prior to birth irregularities are to be found.

Under pathological causes we have another factor producing malformations, *i. e.,* fœtal diseases, but as they probably do not play an important part in the production of malformation we will not dwell on them.

Mechanical. I have dwelt at some length on two of the three etiological factors influencing malformation, heredity and pathological; there still remains the third and perhaps the most important factor. Of all the known causes, the pressure exercised by the uterus and the fœtal membrane, as a result of a deficiency in the amount of liquor amnii, is undoubtedly the most significant. The damage caused by this condition manifests mainly in the extremities, and, according to the view of some writers, Jansen (19), Winckel (20), Birnbaum (21), and others, anomalies of the amnion play the most important part in the production of malformations, and are considered to-day of the greatest importance.

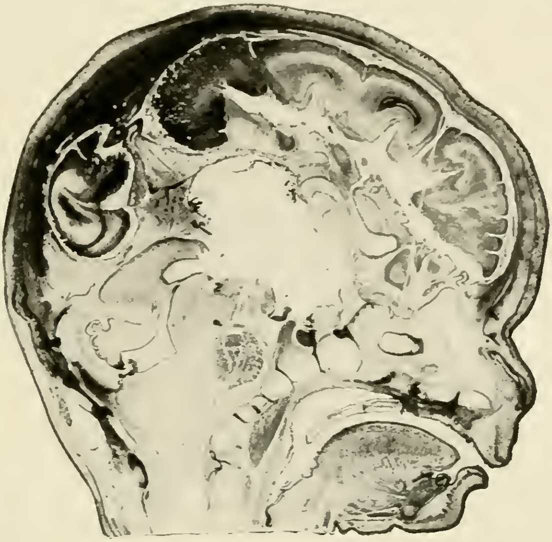


Fig. 14. Sagittal section of head of foetus, micro-photograph of frozen section. Showing distal relation of mandible.

Fig 6 shows the embryo involved within the amnion. As stated earlier, it is during the germ cell period that the first rudiments of the individual is laid down. Surrounding the embryo and within the outer surface is found the liquor amnii, varying considerably in quantity.

After the first month the amnion begins to grow more rapidly than the embryo, at the same time enclosing more and more liquid. Thus between the fourth and sixth week the amnion is separated from the surface of the fœtus to the extent of 1-3 mm. In the cases where the quantity falls below the normal the amnion may form abnormal unions with the embryo, thus producing malformations. Occasionally bands of fibrous character traverse this cavity, and tightening upon the embryo during its growth will produce malformations. The pressing amnion seems able to cause during the development of the skeleton a wrinkling of the embryonic axis—arrest of growth. Infolding of embryonic axis—stunting growth and a curving of the extremities. It thus disturbs the nutrition and growth of parts of the fœtus without interfering with the normal process of development of other parts of the body. Here is to be found the most likely cause for hare-lip and cleft palate and malrelation of the dental arches.

The study of the mechanical malformations shows that the normal head bend of the fœtus is accentuated by external forces or pressure; that pressure on the head curve must push the region of the branchial arches and the future face against the organs of the chest and chest wall, causing the floor of the mouth to approach the roof of the primitive bucco-pharyngeal cavity. From this we can readily see that there is hardly any part of the infolded embryo that is more exposed to the dangers of the increased pressure than that in which the branchial arches are squeezed against the chest wall. This pressure interferes with the blood supply, causing a disturbance in circulation, a temporary disturbance in nutrition, and a stunting of growth of the parts affected.

Before proceeding further let us see if it is possible and in what manner forces acting against the embryo might displace some of the bones of the face and thus bring about malformation. Jansen (22) has gone into the results of amnion-pressure very thoroughly. "In doing so," he says, "we leave the province of facts and enter upon the field of hypothesis; but the step is allowable, because an embryo has not yet—so to speak—been 'detected in the act.' Moreover, we shall find reasons for some confidence that though dealing with hypothetical factors there is a strong element of probability in the nature of the influences which the study of the facts of the case compel us to formulate; for it is obvious that pressure on the head-curve must needs push the region of the branchial arches and the future face against the organs of the future chest and the chest-wall. It is quite intelligible that this is the way in which the region of the future nose has been either partly or wholly flattened and the hard palate displaced in the direction of the base of the skull. So an accentuation of the normal neck-curve subjects the parts of the future face to a compression which fully explains their characteristic malformation."

. The following figures from the above work clearly illustrates the theory of amnion-pressure: Fig. 7, "Mesial section through basis cranii and face of normal fœtus" (from Kaufmann), the outline being placed parallel to the mesial sections of Figs. 8, 9, 10, 11. In Fig. 8 "we find a mechanical pressure has acted upon the face in the direction of the arrow a, which has pressed both the nose and the hard palate backward. The parts of the mouth have been squeezed between the base of the skull behind and some compressive influence in front. This pressure has also changed the direction of the palate; its posterior position has been tilted upwards, so that the angle which it forms with the basis cranii, has been made greater than normal, indicating that under the chin a similar mechanical pressure has been at work in the direction of arrow b." "The very same phenomena are visible in Figs. 9-11. The sagittal dimensions of the mouth cavity are reduced, moreover the profile line of the lower jaw appears to be pushed inward, showing that an abnormal pressure against the jaws has acted in a backward direction."

The above conclusions were later verified through X-ray photographs.

We must remember that the pre-maxilla develops from the nasal process in the mesial part of the face, whilst from the lateral process of the upper jaw the hard palate grows in a medial direction until it joins the pre-maxilla anteriorly and the horizontal plate of the palate bone posteriorly. An abnormal pressure will compress these and cause the palatal portion to be pushed upward.

Herewith we have opened up the subject of mechanical malformations and that the effect of amnion pressure is characterized by two groups of phenomena, interference with growth and mechanical malformation.

Thus we may presume that the region of the dental arches can be either partly or wholly compressed and the hard palate displaced in the direction of the base of the skull; and here we find the most likely cause for malrelation of the dental arch in infants.

The peculiar position which the fœtus assumes allows little room for the limbs, especially the hands, and thereby influences the development and growth of the surrounding structures. (Fig. 12.)

There is one other factor that has the greatest bearing on the child's future, and one which certainly leaves its influence on the face and cranium, often bringing about malformations and unsymmetrical development, and that is the results of birth, instrumentation and moulding.

In reviewing the important factors that influence the development of the facial area during prenatal life, I have only endeavored to show those that are of the greatest importance.

Before concluding, let us review carefully the following photographic illustrations:

Fig. 13., a and b. Coronal section of heads of embryo (variations).

Fig. 14. Sagittal section of head of embryo.

Fig. 15. Skulls at full term, normal.

Fig. 16. Skulls at full term, receding mandible.

Fig. 17. Skulls at full term, protrusion of mandible.

Fig. 18. Skull of infant about fifth month—marked protrusion of mandible.

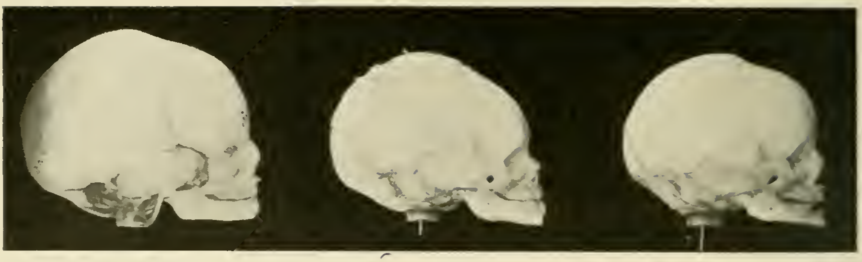


Fig. 15. Skulls at full term. Normal relation of dental arches.

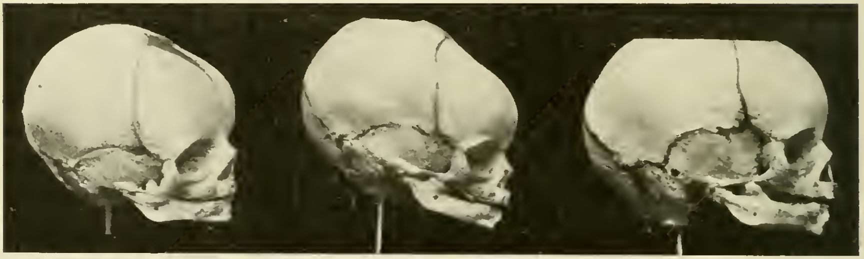


Fig. 16.

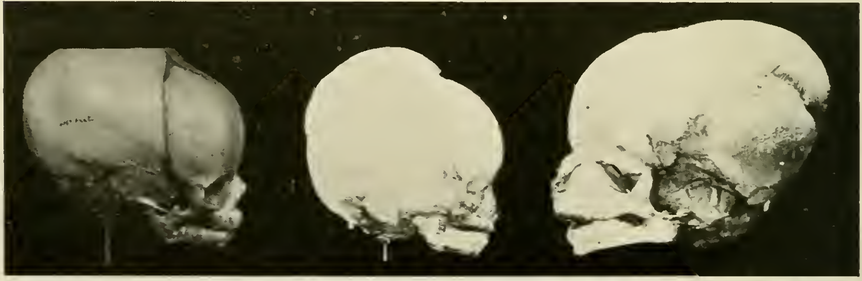


Fig. 16. Skulls at full term. Distal relation of mandible.

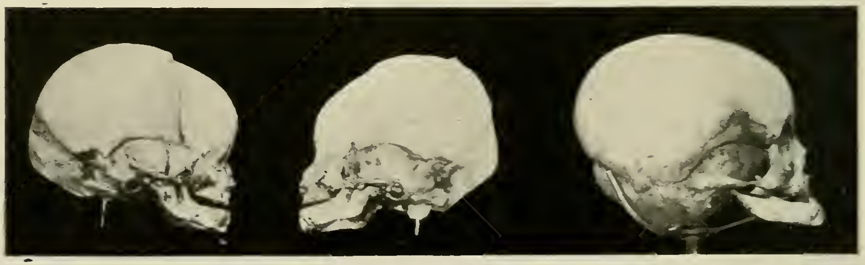


Fig. 17.

Fig. 18.

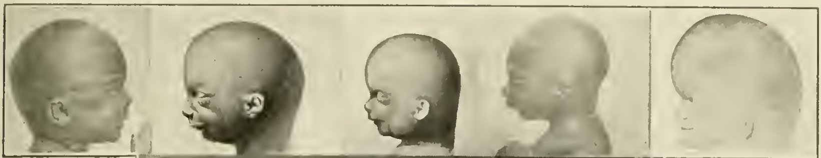
Fig. 17. Skulls at full term. Protrusion of mandible.

Fig. 18. Skull of infant about fifth month marked protrusion of mandible.

Fig. 19. Series of embryo, same age, showing marked retrusion and protrusion of mandible.

Fig. 20. Illustrations of infants prior to six days, showing normal and malrelation of dental arches.

Fig. 19. Series showing a marked retrusion and protrusion of the mandible. Same age. (Retzius).



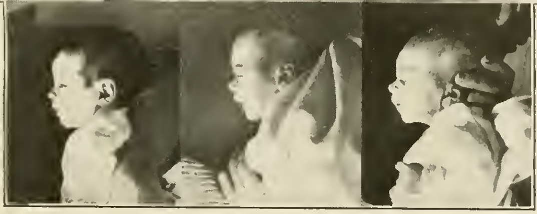
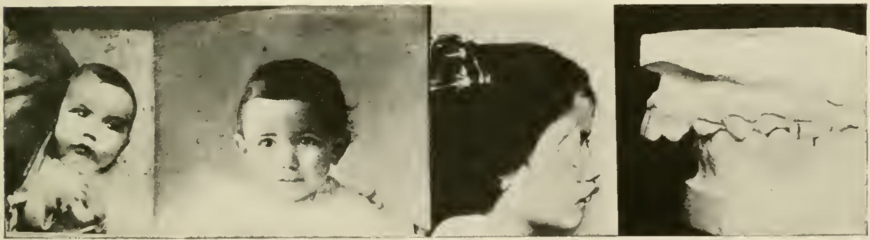


Fig. 20. Illustrations infants prior to six days, showing normal and malrelation of dental arches.



A. B. C. D.

Fig. 21. Illustrates when early malformation is retained in a marked degree through life. (a) three months, (b) 1 year, (c) 8½ years (d) model at that age, although all second teeth are through.

Fig. 21. Illustrates early malformation retained in a marked degree through life. (a) 3 months, (b) 1 year, (c) 8½ years, (d) model at that age, although all second teeth are through at 8½ years.

During the last four months I have examined in the various maternity hospitals in New York City over 500 new-born infants, all under four days' old. The result of these examinations shows the percentage of infants with malrelations of dental arches to be very small, but both retrusion and protrusion of the mandible were observed; that practically every infant has a well-defined mental process, contrary to what has previously been written.

Conclusion.

1. We thus find that all parts of the anatomy, the facial perhaps as much as any other, are liable to abnormalities in development.

2. That we have malrelation of the dental arches, malformations and conditions to contend with prior to birth, varying in a marked degree.

3. That these conditions are brought about in a great many cases as early as the second or third week of fœtal life. Hellman in his excellent paper (23) (24) says "that malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast feeding." Malocclusion of the teeth cannot be attributed in a great many cases to bottle feeding, as normal breast feeding is interfered with by conditions brought about before or at birth, through the malrelation of the dental arches (see Fig. 21), for malformations are not always the result of late, but are often of early intra-uterine pathology or mechanical disturbances during the embryonic or fœtal period.

4. That whatever the early embryonic or fœtal malformations might be, they are generally retained in a marked degree in adult life.

5. While internal secretion may in a large measure account for many of the unsolved mysteries of pathological conditions, it does not seem possible that the pituitary body, owing to the effect it has on the skeleton as a whole, should play the important part in malformations and malrelations of the dental arches; these conditions undoubtedly have their origin prior to the time of the activity of these glands.

6. That most of the early abnormal conditions will undoubtedly be found to be the result of mechanical disturbances, probably as the result of amnion pressure.

7. There is a definite relation of the dental arches at birth, with a well-defined mental process or chin.

We have only begun to search for the causes of malrelation of the dental arches, and that also holds true for malocclusion of the teeth. For the next step in the study of orthodontia we must learn what influences bring about certain specific malformations during ontogenetic development. Orthodontia is not and cannot longer be considered mere mechanical treatment. Our profession is entitled to the scientific standing it has been given; to further this we must overcome the idea of its being purely mechanical and place it in the scientific rank and position which it deserves.

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Discussion of Dr. Weinberger's Paper.

Dr. Bogue. Dr. Weinberger states that his object in writing this paper (which is truly remarkable) on pre-natal factors that influence the development of the facial area and cause some of the malrelation of the dental arches at birth, is to set thinking those who do orthodontic work.

His most important statements Dr. Weinberger has epitomized in a few short sentences. For instance, he says: "We have pre-natal factors that control some types of malrelation of the dental arches, and these abnormal relations begin at a much earlier period than has previously been recorded." This is a very important statement. Another important statement is that: "Nearly all malformations (embryonic and fœtal) originate in the first six weeks of intra-uterine life, or the embryonic period, and *'when the malformed embryo becomes a fœtus, it carries whatever malformations it has into the fœtal period, and is born with same.'* Therefore, congenital malformation is not always the product of late, but of early uterine pathology." He brings in also Schwalbe's definition of a malformation as "an alteration occurring during fœtal development, *e. g.*, a congenital alteration of one or more organs or systems of organs, or of the whole body, which does not come within the range of variation of the species." This excludes a temporary arrest in what might have been normal development.

Dr. Weinberger confesses, however, that Dewey, Talbot, Hus, and others have written much concerning heredity, but this has never clearly been worked out. He therefore comes presently to mechanical influences which involve amniotic relations as well as fœtal positions. All the light we can get on these positions, and relations must come very slowly, and it would be presumptuous for me to enlarge on those points. I think it has been demonstrated that most infants are born fit, and Dr. Weinberger confirms this statement so far as the well-defined mental processes are concerned, although this may be contrary to what has previously been written.

He has shown us a number of skulls at full term with receding mandibles (that is, if the skulls are rightly articulated); he has shown us (Fig. 16) also a number of skulls at full term with protrusion of mandibles (also subject to the same error); still more remarkable is the skull of an infant at about the fifth month of uterine life with marked (Fig. 17) "protrusion of mandible"; no hint is given as to heredity or accident, and then the series of embryos about the same age showing both (Fig. 18) retrusion and protrusion of mandibles.

The models showing malrelation of the mandible prior to birth and the malrelation of arches prior to six days certainly give rise to thoughts which will probably eventuate in still further investigation along these lines when some equally enthusiastic, industrious and persistent investigator is willing to spend and be spent as Dr. Weinberger has been willing in order to discover the truth.

Dr. Weinberger states that he has examined five hundred new-born infants, all under four days, and that the result of these examinations shows the percentage of infants with malrelations of dental arches to be very small.

In the second paragraph of Dr. Weinberger's conclusion he says: "We have malrelation of the dental arches, malformations and conditions to contend with prior to birth, varying in a marked degree." As the Doctor nowhere alludes to hypothyroidism existing in the mother, and makes no suggestion as to ante-natal treatment, I am forced to conclude that he means that what we shall have to contend with will come *after* birth, though its causes may be ante-natal. I cannot help thinking that Hellman is right in suggesting that the absence of the breast and the normal mother's milk creates conditions unfavorable for the perfection of the normal, and that if we can early diagnose these mal-relations of the dental arches we may often successfully contend with those conditions *after* birth.

In Dr. Weinberger's fourth paragraph he states "that whatever the early embryonic or fœtal malformations might be, they are generally retained in a marked degree in adult life." This is a very important reminder, as also is his sixth paragraph, "that most of the early abnormal conditions will undoubtedly be found to be the result of mechanical disturbances, probably the result of amniotic pressure, but probability is not science."

I understand Dr. Weinberger to state in conclusion that we have only begun to search for the biological causes of malrelation of the dental arches and malocclusion of the teeth. I feel like adding the statement that in all of the worst cases of maldevelopment of the dental arches and facial regions we shall also find associated with these conditions a curvature of the spine, an interference with the thoracic cavity and other indications that these malformations and positions can no longer be regarded as local affections, but must be regarded as manifestations of ortogenetic development.

Perhaps we may hope that Dr. Weinberger's next excursion may be along the lines of the mechanical influences which do not stop with birth, but which continue into the domain of the glenoid fossæ when we get them, for at first there is no fossa and the position of the mandible becomes limited only when an "eminentia articularis" has been formed.

Dr. Weinberger. In closing the discussion, or, rather, the discussion of Dr. Bogue, I find there is little that can be added to what I have already described. Under the circumstances of its presentation it was practically impossible to discuss this subject, as lack of time permitted merely that slides be shown and that the reading of the paper in its entirety be cut short. Heredity is not the only factor; in fact, it is a question in my mind as to just how much influence it has in the production of these malformations. The reason you can see for yourself when you read the paper. The influence of pressure, the direction of this pressure, is the important point I wanted to bring to your attention. It undoubtedly has a great bearing on later malformations. Could we influence the medical profession in this our work undoubtedly would be simplified. I have endeavored to have Dr. Franklin P. Mall, of Johns Hopkins, and others aid us, but so far I have been unsuccessful. I have tried to bring to your attention the fact that there are infants who are unable to be fed normally (breast fed) and consequently are put on the bottle. That this is due to the malrelation of the dental arches there is no doubt.

Growth and Function of Tissues Involved in Orthodontic Treatment.

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Unfortunately for the study of tissue changes, in orthodontic treatment we can have no post-mortems, and even if this were possible, any material of clinical value would only be obtained in faulty treatment where stimulation had been excessive. Our deductions as to tissue changes must be based upon results of research on human tissue during regeneration and repair, pathological as well as physiological.

By *physiological regeneration* is meant the replacement of material which is used up in the normal functional wear and tear, such as covering epithelium of skin and mucous membranes, hairs, sebaceous glands, cells of sexual glands, blood-forming organs, etc.

By *pathological regeneration* is meant the restoration of cells or tissue to fill in a pathological defect; especially for preservation of an unbroken continuity of the tissues.

In physiological regeneration there is a complete structural and functional replacement of the lost cells; but under pathological conditions such a perfect regeneration often does not take place. When the effect is superficial and does not involve the basement membrane the lost cells may be replaced by cells of their own kind. This is termed *true regeneration,* but when the defect involves the supporting connective tissue and the blood vessels as the result of more severe injury, the regeneration is imperfect and the newly formed tissue does not have the functional value of the old (*imperfect regeneration* or *repair*). The new tissue may show marked morphological changes from the old (*atypical regeneration*). The new tissue may be larger in mass than the old (*hyper-regeneration*). In other cases the new tissue may be absolutely different in morphology and function (*heteromorphosis*). The replacement of parenchymatous cells by connective tissue is generally spoken of as *repair* (granulation tissue, scar tissue, cicatrix, etc.); atypical and excessive regenerations are usually associated with chronic inflammation.

Regeneration and repair take their origin from nucleated living cells; the intercellular substances play no rôle in it. The cells both of parenchyma and of the supporting tissues are capable of regeneration (surface and glandular epithelium, muscle, nerve-fibers and connective tissue). As a rule, the power of regeneration diminishes with the increase in morphological and functional differentiation. Capacity for regeneration is greater in the lowest forms of life and diminishes as the forms become more complex. Protozoa can regenerate the entire cell from fragments of cells containing chromatin; echinoderms and worms have great regenerative powers; anthropods and crustaceæ can regenerate entire extremities. In the vertebrates the regenerative capacity becomes reduced as the scale ascends, until in man the regenerative capacity is limited to certain cells and tissues only, but not of organs or parts.

The more highly specialized the animal or tissue the less its regenerative capacity. Ganglion cells cannot regenerate. Muscle and nerve fibers have a limited regenerative capacity; surface epithelium has a greater than glandular; while the greatest regenerative capacity is shown by connective tissue and blood vessels. The healing of defects in glandular organs, muscles and nervous tissues takes place chiefly through the proliferation of the supporting tissues (connective tissue and neuroglia). The regeneration of the parenchyma occurs to a much lesser extent, or in some cases is wanting entirely. Such imperfect regenerations lead to *scars* or *sclerosis*.

Embryonal tissues have a greater capacity for regeneration than differentiated ones, but even with these the more highly specialized tissues show it in a less degree.

Regeneration takes place through cell-division, chiefly mitotic; but in pathological regeneration amitotic division, as well as atypical mitotic, is very common.

Law of Specificity.

Omis cellula e cellula eiusdem generis. Epithelial cells can only produce epithelial; connective tissue cannot produce epithelium, muscle or nerve tissue.

Metaplasia of Tissue.

Within narrow limits, however, a tissue may take on the morphological and functional character of another closely related tissue. The boundaries of such metaplastic processes are limited; only the surface epithelium and the connective tissue group (connective and elastic tissue, tendon, cartilage and bone) are capable of metaplasias. Squamous epithelium may be changed into columnar ciliated, or mucoid cells, or vice versa; connective tissue may be differentiated into adipose tissue, tendon, cartilage or bone; cartilage into myxomatous tissue, etc. Such metaplasias may take place without any new formation of cells, the old ones persisting (*direct metaplasia*); or the *neoplastic phase and metaplastic phase.* This second form may be called *regeneration with a change in differentiation.* Most of the true metaplasias are of the second type (development of bone from connective tissue or cartilage). The new differentiation may lead to the development of a more highly developed tissue (*prosoplastic* or *progressive metaplasia*) as in the change of bile duct epithelium into liver cells, duct epithelium of salivary glands into specific functionating gland cells, etc. In other cases the transformation may be from a higher into a less differentiated tissue (*anaplastic* or *regressive metaplasia*), as ganglion cells into ependyma, duct-epithelium into epidermis, etc.

Causes of Regeneration.

Stimuli to growth. (Most important of all is an *increase of functional stimuli,* both general (nutrition, movement, increase, etc.), and specific functional stimuli. Also *chemico-physical stimuli* (little is known of these: experiments with Sudan III and Scharlach R-oil, ether-water, and various lipoid-soluble substances, etc.) While proliferations are produced by such substances, they are preceded by injury to the cells; and the theory of "proliferation-substances" as direct stimuli to growth (formative stimuli) is not proved. Nevertheless, chemical substances are of great importance in determining the direction of growth.

Chemotactic Influences.

Fibrin, dead leukocytes, dead tissue cells, exert a chemotactic influence upon fibroblasts and developing blood vessels; portions of tissues separated find each other; new axis-cylinders follow the path of the old dead ones, etc. Poisons, toxins, etc., alter the character of the proliferations produced by them. Chemically active material (*hormones*) from glands of internal secretion (sexual glands) excite proliferation and growth in certain organs and tissues (breasts, hairs, etc.).

Recent progress has been made by chemical research workers upon the chemical questions relating to growth by the study of nutrition. This more modern plan has meant a determination of what constructive units are essential for the building up of an adult organism, what materials must be furnished to the growing individuals, what possibilities of synthesis are inherent in them and will enable them to supply by construction the necessary tissue components. The successful pursuit of this method of inquiry depends upon the justifiable assumption, already mentioned, that protoplasm, if it is constructed at all, is not made into a fundamentally defective variety of diet, though deficiencies in the latter may lead to an unmaking of cells already developed.

Nutrition.

And now, at a time when the energy problems of growth have reached a degree of solution that gives a clear and fairly comprehensive insight into this aspect of nutrition, so that this chapter of physiology can at length be reviewed with a fairly satisfactory understanding of what it involves, entirely new questions have thrust themselves into the foreground. Physiologists have long realized that the ideal way to study the problems of nutrition would be by feeding artificial mixtures of the isolated and purified nutrients. The successive failures of the attempts in this direction, which need not be detailed here, coming in conjunction with evidence from other sources, have awakened us to the realization that perhaps something more than the familiar proteins, fats, carbohydrates and inorganic nutrients are essential to the persistence of the life process or the accomplishment of prolonged growth. The modern researches on the physiological significance of the secretions of the ductless or so-called endocrine glands and the growing evidence for the regulatory function of hormones or chemical stimulants distributed by the circulation have made it easier to believe that substances which are neither significant as sources of energy nor sufficiently abundant to construct new portions of protoplasm may nevertheless exercise a dominant effect upon nutrition. To one who has been brought up in the study of exact stoichiometric relations in science there is something almost unscientific and mystical in the discovery that mixtures of food stuffs which are selected from the chemist's supplies and fail to maintain animals can be made adequate by the addition of milk, for example, in quantities far too small to have significance as a source of energy. We are dealing here with what have been called food accessories or "vitamines."

Growth appears to be in some degree dependent upon the presence of chemical determinants of this order. For the present they must not be confused with other known essential nutrients, with suitable amino-acids, or inorganic salts, or appropriate carbohydrates. It must be recognized at the outset, that unless the conditions are suitable for maintenance, growth, which is normally superimposed upon it, cannot proceed. The value of food accessories of as yet unknown chemical nature has been made evident of late by feeding experiments with isolated food substances, where additions of small quantities of naturally occurring products have prevented nutritive decline or brought restoration. This is notably true of the "protein-free milk" devised by Osborne and Mendel for feeding rats. No artificial imitation of this natural mixture, which contains milk-sugar, inorganic salts and very small quantities of unknown ingredients, has been devised to replace it satisfactorily for considerable periods of growth. The success of the "natural" product seems to be dependent upon the presence of undiscovered "determinants" in minute traces. Evidence for the existence of such accessories is further furnished by the so-called deficiency diseases. In some cases heating seems sufficient to destroy some thermolabile determinant of maintenance. The development of scurvy from the use of heated foods is an illustration of this point

However, an adolescent animal may actually fail to grow upon a diet which serves well to maintain an adult individual of the same species. Grown rats have been kept in good health for many months on a ration consisting of protein, sugar starch, "protein-free milk" and lard. Upon this diet the young of the same species grow for a limited period and then invariably decline. We have had the almost paradoxical experience that those animals which grow on the diet mentioned presently die, whereas those which do not experience growth are more likely to continue to live. How or why do these chemical determinants promote growth? The best that we can do to-day is to recite the facts. Perhaps they promote appetite and lead to gain of weight by inducing suitable food intake. It is not easy to reconcile such a hasty explanation with the marked differences between the facts studied. Perhaps they merely represent chemical ingredients necessary at all times for the body cells, but needed in great abundance during increment in size and therefore not available in sufficient amounts in a diet adequate for mere maintenance with limited wear and tear or tissue loss.

Artificial parthenogenesis may be set up by non-specific chemico-physical substances. This is *development* rather than *growth*, and such occurrences cannot be taken as proving the existence of chemical formative stimuli.

Theoretical action of ferment and antiferment. No evidence. Hypothetical inhibitory influences and growth due to removal of these. No proof. Action of heat and cold within certain limits, hyperæmia, increased food-supply, are all favoring factors, but not direct formative stimuli. *Causes of growth are inherent in the cells themselves.* They regulate their own growth.

Chemical analysis of growing cells and tissue reveal very little of clinical value. It is known that embryonic and growing cells are rich in water which diminishes with age, and there is more or less quantitative variation in composition at different stages of growth, yet no striking facts have yet been furnished by the devices of tissue analysis. From a purely biological standpoint it is of interest, and a result perhaps to have been anticipated that there is a fixity so to speak in the composition of animal structures at various sizes of the same individuals. The number of cells or the volume of each of them may be increased enormously; yet broadly considered analytical data show no striking differences in the chemical organization of the resultant protoplasmic mass in comparable tissues at various periods. Aside from transitory depositions of reserve materials, such as glycogen or fat, muscle remains alike in its gross composition, and the nervous substances exhibit essentially the same chemical charcteristic components, independent of age, diet or environmental condition.

A deficiency in the diet, a lack of some food component, is not responded to by growth in which the tissues produced are chemically normal and show a depletion in the missing factor. Its composition remains unaltered. Normal growth can proceed only when all the important constituents are assimilated in the proportions in which they make up the body. Losses are sustained only by the uniform disintegration of the tissues, whereby their relative composition remains unaltered. Outside influences disturb the equilibrium within the cell and growth does not take place until that is restored. The nature of this equilibrium is not known. Between nutrition and proliferation there is the closest relationship; the disturbance of cell equilibrium may consist in a disturbance of this relationship. External stimuli may alter the chemico-physical character of the protoplasma so that nutritive material is more readily taken up by the cell.

Causes of growth outside of the cell are, under pathological conditions: Changes in environment, disturbances of cell-relationship, altered chemico-physical relationships, changes in tissue-tension, removal of hindrances to growth, etc. Hyperæmia, œdema, formation of secretions, etc., by changing the tissue tension, cause a pathological growth. *Increased functional needs cause increased growth.* The ability of the organism to react to this intrinsic and inherited factor plays the chief rôle in all processes of growth. Individual differences in growth-energy exist as the varying reactions to external injury show. Some individuals show little capacity for growth and repair; other individuals may show an abnormal regenerative power, manifesting itself in pathological growths, neoplasms, etc.

In Dr. Carroll's experiments, life was sustained in connective tissue outside an organism for more than eleven months and its mass increased considerably, and its power of proliferation after such a long period is more active than at the beginning of its life in vitrio. The tables of Dr. Carroll's experiments, published on pages 275 and 284, inclusive, of the *Journal of Experimental Medicine,* Vol. 17, are very interesting, but time will not permit of their introduction here. These experiments have shown that extracts of tissue and tissue juice, under certain conditions, accelerate the growth in vitrio of connective tissue from about thirty to forty times. This activating power was found in many tissues. It was much more marked, however, with the extracts of embryos of adult spleen and of Rous sarcoma. The power diminished directly with the dilution of the extracts, and appeared not to apply to the tissues of a heterologenous animal. The power was reduced when heated at 56 degrees C. and removed when heated at 70 degrees.

Functional Accomodation.

Growth, hypertrophy, new formations of tissue and tissue metaplasias result from change in the kind and degree of functional demand. Overwork leads to compensatory hypertrophy. Destruction of part of an organ leads to hypertrophy of the remaining portion. Changes in environment leads to metaplasias. Changes in *pressure, stress* and *strain, pulling, drawing, bending, stretching,* etc., lead to growth with changes in the direction or differentiation of the tissue. Changes in the direction of the load borne by bones will change the character of the bone; where pressure is greatest new bone is formed; where it is least, atrophy of the bone occurs. *Two strong* or *too lasting pressure* leads to disturbances of nutrition and to atrophy. Changes in the character of the bone itself result from changes in pressure, strain, etc.; concentric radiating structure may be produced—changes in the direction of the bony trabeculæ in the direction of the strain result. If a portion of the ulna be transplanted into the position of a metacarpal bone it will become changed so in its new situation that it will come to resemble the removed metacarpal bone.

Similar functional accommodations occur in connective tissues: Increase of stress, strain, pulling, tension, causes an increase of connective tissue with its fibers running in the direction of the pressure; elastic fibers are formed in response to stretching demands; loose areolar tissue where sliding or slipping movements occur. In tendon transplantation the intensity of the proliferation, the topographic distribution of the new formation, the relative amount of connective tissue and tendon cell proliferation, the abundance and order of the fibers are all dependent upon *mechanical* conditions. Even a sort of new tendon sheath may be formed as the result of the functional working of the new tendon. In the heart valve-like pockets may be formed in the endocardium in aortic insufficiency as the result of the formative power of the blood stream, just as the valves were formed during embryonal life. False joints may be formed as the result of the movements of fractured bones, with formation of cartilages in the callus. Bone may be formed in connective tissue as the result of long-continued pressure or strain (drill bond, Rider's bone, dancer's bone, etc.).

Such functional accommodations may undergo involution when the mechanical forces calling them into existence no longer operate. The new tissues are pathological and less valuable than natural, and show peculiarities of structure according to the direction and degree of the acting mechanical force.

Deductions.

Growth in orthodontic treatment cannot be assisted in any scientific manner by any specific chemical element or combination of chemical elements.

Good, wholesome general diet should be followed in all cases.

Growth of tissues involved in orthodontic treatment can be retarded by any disturbance in any part of the body which will interfere with metabolism.

Mechanical stimuli must be slight and preferably interrupted at different periods to produce the most satisfactory results, application of which varies greatly in different cases.

Physiological stimuli. All tissue involved must perform proper function to retain proper balance of natural stimulation not only to themselves but to adjoining tissues.

Most important is normal breathing and mastication, both of which must be maintained throughout treatment in order to develop natural stimuli to tissue.

All *abnormal stimulation* must be removed, such as stress produced by habits, examples of which are finger-sucking, lip-biting, etc.

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Discussion on Paper of Dr. O. W. White.

Dr. Burt Abell. Dr. White's paper reminds me of Josh Billing's remarks on courting. He says: "Courting is like peaches and cream, it wants to be did slow so you can git the flavor."

When Dr. Flint asked me to discuss a paper I readily consented, for, as the old lady said, I felt "conscious-smut" for not having attended the last two or three meetings, and wanted to redeem myself. But when I read Dr. White's paper I felt exactly as I did the first time that I got into water over my head, I began to call for help. I immediately engaged a truck and proceeded to make great holes in all the libraries of my medical and dental friends, and brought the books home and piled them in a great pile and put a sign on the door, "Nobody Home." I started out to see if I could trail the doctor through the jungle. I soon came to the conclusion that, so far as I was concerned, I had got the right label on my door.

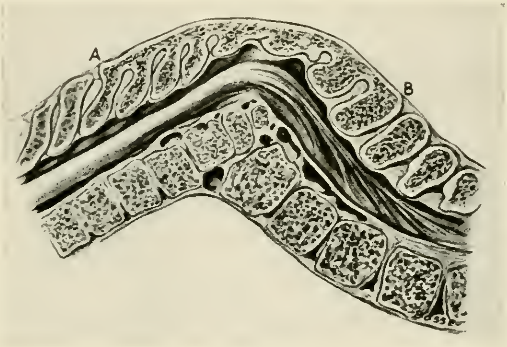


Fig. 1.

Then I read his paper again, and came to the conclusion that while I in my spare moments had been trying to make my peach and apple trees clap glad hands at the summer skies, Dr. White had been digging down at the root of things and was bringing up hidden things to tell me if I could only see them. His position reminds me very much of Capt. Koenig's account of how the *Deutschland* evaded the English blockade in the channel "We just nosed down around the bottom while the English raged on the roof." Dr. White has been digging in at the beginnings while we have been messing around with metals and strings and springs and things.

Hellman, of New York, says: "It is rather paradoxical to think that the best minds in this specialty (orthodontia) should seek the solution of a problem of such vast proportions by devising and multiplying the means of treatment of various conditions without eliciting more strenuous efforts in the search for more exact knowledge of the causes that bring them about."

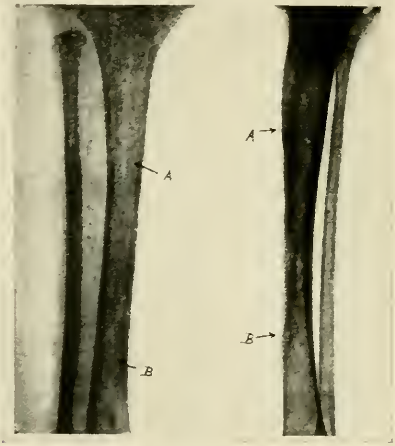


Fig. 2.

Dr. Angle states that "the causes of malocclusion, to be intelligently comprehended, must be studied from the basis of the normal growth of the denture and its correlated parts. Most of the immediate causes are mechanical, yet whatever acts as a hindrance to Nature in performing her delicate offices in the unfolding of the various tissues composing the dental apparatus during its growth will operate as a cause in producing malocclusion."

To properly study the restoration of functional activity and growth of the tissues involved in orthodontic treatment, we must know something of the normal growth of the tissue when undisturbed, and also discover the disturbing cause of the malocclusion, that it may be intelligently met in treatment.

Feeding the Baby.

More and more the conclusion is forced upon us that the disturbing cause of malocclusion is often of very remote origin, often beginning at or before birth. A vast field of research in the remote causes of malocclusion and loss of function lies in the problems of feeding the infant. These problems are both chemical and mechanical. Where breast-fed the disturbing causes are reduced to a minimum. Hellman in a series of investigations finds that out of thirty cases examined, ranging from two to seven years, five were breast-fed and twenty-five were breast and bottle-fed. Of the five breast-fed, three were apparently normal, two presented malocclusal conditions. Of the twenty-five breast and bottle-fed, four were apparently normal and twenty-one had malocclusion. We have always recognized the mechanical difficulties—the difference in the rubber and breast nipple in its resistance to the pulling of nursing, etc., but who will find out for us the exact effect in the matter of nutrition upon the growth of the tissues involved in our field. Dr. White has given us an impetus in the right direction. What are the conditions in the mother that are making it more and more necessary to bottle-feed babies? What effect does this deficiency have in the developing child? It has recently been demonstrated that deficiency in thyroid activity would lessen the supply of milk and thyroid extracts would increase it. The thyroid apparatus has been removed from young puppies who showed no disturbance while being suckled, but when this was suddenly stopped the animals died, showing that the milk excreted the active principle, as Bang states. Can this be a starting point for someone to begin to remedy the trouble?

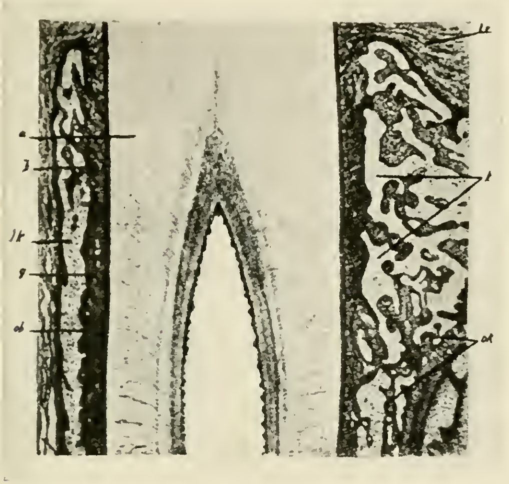


Fig. 3.

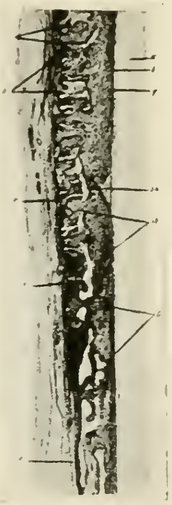


Fig. 4.

Another thing to investigate more carefully is to find the constitutional causes of malocclusion. Get out your spy-glass and see who there is appearing on the horizon inspired to dig into the hidden field and win everlasting fame by solving this problem. Here is a chance for some of you young fellows. Why is it that in rickets the malnutrition should cause such poor bone structure that the teeth cannot stand the stress of mastication and the upper arches become constricted and the mandible spreads all out of proportion?

What is there about this disease that quickens the absorption of the roots of the temporary set, while in tuberculosis the absorption is so long delayed that malocclusion results from too long retained teeth? Both presumably due to malnutrition. You see, not being a scientist, or even a pseudo-scientist, I can only suggest, not solve.

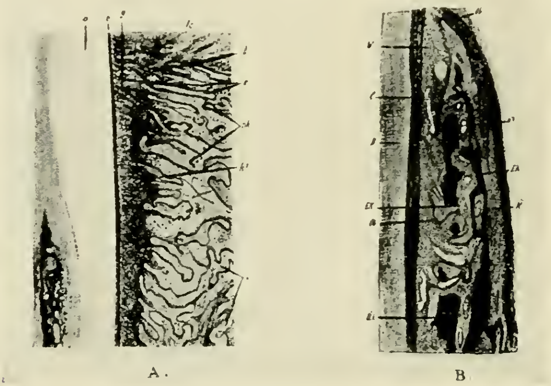


Fig. 5.

A study of the changes of bone structure under stress is interesting and pertinent. Wolff's law briefly stated is as follows: "Every change in the form and position of the bones or of their function is followed by certain definite changes in their internal architecture, and by equally definite secondary alterations of their external conformation, in accordance with mechanical laws."

Fig. 1 shows antero-posterior longitudinal section of a spine two years after the tibia bone graft had been implanted into its split spinous processes to ankylose the tuberculous infected verterbræ present between A and B. The drawing was made from an actual specimen and represents the alteration which has taken place in the character of the graft and its bed. The area A to B has been so changed that it presents the characteristics of a single bone with a distinct contex enclosing cancellous bone structure throughout. It has become identical in its anatomical structure to the spinous processes to which it has become amalgamated, adapting itself to its environment.

To further illustrate Wolff's law, Fig 2 shows two views of a tibia from which a graft had been removed. The cavity has been filled in and under influence of Wolff's law the tibia has become nearly as strong as before the graft was removed. We are led to the conclusion that the alveolus and maxillæ are responding in a similar manner and similar changes are transpiring depending on amount and direction of force applied.

Dr. Albin Oppenheim, of Vienna, to discover if possible the nature of changes in the tissue incident to orthodontic treatment, utilized several babboons for his experiments. He adjusted the Angle appliances, and after forty days killed the animals, imbedded and stained the necessary tissues and made sections for study.

Fig. 3 shows a section of tooth and alveolar process under normal conditions. Note the arrangement of the bone, lamellar on the labial side and cancellous on the lingual; spicules next to the tooth are parallel to the long axis of the tooth. Fig. 4 illustrates the *labial* side of an incisor after forty days' pressure. This has every appearance of young bone in the process of calcification, the forces of deposition under continued pressure gaining over those of resorption. Note the original lamellar arrangement of the bone opposite the apical third of the root undisturbed by the pressure.

Fig 5 shows the *lingual* area at A after forty days of pressure in a *labial direction.* Note the arrangement of the bone spicules at right angles to long axis of tooth in the upper two-thirds opposite pressure area, the spicules following the direction of force applied. In the lower one-third the bone is practically undisturbed.

Fig. 5 at B is after six months of retention; the osteoblasts are depositing new bone, and there is an approach to the original arrangement.

Dr. Richard Summa. In the discussion of both papers this morning reference was made to the response of bone growth to mechanical stimuli. Dr. Abell very plainly stated Wolff's law concerning the arrangement of pressure and tension curves of cancellous bone as dictated by mechanical stimuli; Prof. Walkhoff, of Munich, wrote an extensive and interesting work in regard to the influence of the function of the teeth on the cancellous structure of the mandible. He used for his experiments the mandibles of anthropoid apes, and by means of X-rays showed rather plainly that the arrangement of this spongy structure is not haphazard, but it is in strict accordance with the laws of mechanics recognized by Wolff.

We may justly assume that the pressure and tension curves of cancellous bone of the mandible are dictated by the force of mastication, and this force is exerted upon the occlusal and incisal surfaces of the teeth. We likewise know that the force employed in tooth movement is exerted laterally. Hence we have in natural development the mechanical force exerted most occlusally, which will result in tension curves of the cancellous bone; while in the artificial development induced by orthodontic procedures, force is exerted laterally, which will result in a different arrangement of these pressure and tension curves of the cancellous bone.

Therefore, when retaining appliances are removed the cancellous bone must be rebuilt according to the demands of the force of mastication.

I regret very much that these investigations of Prof. Walkhoff have never been translated.

Dr. O. W. White. Doctor Summa spoke with reference to the matter of stress. In regards to this I wish to emphasize the fact that we should never have an appliance so rigid that occlusal forces which are of value can be interfered with.

Interrupted treatment is greatly to be desired, especially in the latter period, but this would be found to vary according to individual and case.

Normal stimulation will always prove more satisfactory in the treatment of our cases and the developing of them, and the disuse of the mechanical will produce more pleasant results.

I thank you for your kind attention.

Recent Advance in Orthodontics of Interest to Rhinologists.

By Dr. A. H. Suggett, San Francisco, Cal.

After reading the various articles published during the last year and a half in the medical, rhinological and dental journals, I am convinced that recent advance in orthodontics of interest to rhinology is along the line of etiology and pathology rather than surgery. In the past we have all been doing repair work; mending and patching after the damage has been done.

Even in the social and economic world, the thinkers are more interested in the cause of crime, corruption and poverty than in jailing the bribed, the briber or the beggar. They are going beyond charity for the poor, back to the causes, or the etiology of poverty. Men are trying prevention rather than cure.

This looking for the *cause* of the disease is noticeable in all magazines, and is one of the splendid signs of the times.

Therefore, it is very interesting to read in the medical journals, article after article, from the pens of the best men in the medical world, relating their search for the cause of disease. It is very gratifying to the dental profession that they are at least recognizing that pus from the mouth will cause disease, just the same as pus from any other location.

I would assume, however, that many of the problems in rhinology, as in orthodontics, are those dealing with patho-histologic or *patho-anatomic* conditions, rather than with infection; with *malposed* tissues, rather than diseased tissues. May I be permitted to liken a deflected septum or malposed turbinate to a malposed tooth or an irregularity in occlusion?

These conditions in my opinion are easily prevented if we have an opportunity to observe the patient early in life. Perhaps if both professions could be in closer touch with the pediatrician we might be able to do more preventive and less corrective work.

Why may we not adopt the policy followed by some of the largest life insurance companies, who annually examine their risks in order to determine their physical condition, and if necessary advise treatment which will tend to increase their longevity?

Would it not be possible and permissible to seek the children in order to keep them well, rather than cure them of their ills? Infected cavities in teeth and various forms of stomatitis may be likened to infected tonsils and nasal passages. Such conditions, even with watchfulness and care, may develop in spite of all our efforts, but if the nasal and oral cavities are in a normal condition there is less likelihood of infectious diseases occurring; the normal child usually possesses greater resistance.

It is most interesting to note the great change in the attitude toward the teeth and the mouth. Page after page is filled with reports of all the ills that the body is heir to, and showing that causes were traced to pathological conditions in the mouth and teeth. The most eminent pathologists in the world are reporting cases of heart lesions, of arthritis, appendicitis, lesions of the ear and the eye, which they claim were caused by pathological condition of the mouth and were cured when the pathological condition of the mouth was removed.

Dr. R. R. Daly, of Atlanta, says he would no more attempt to treat tuberculosis to-day without the aid of a dentist than without assistance of good food and fresh air.

The rhinologist now recognizes that he must have the help of the orthodontist to correct many of the pathological conditions found in the nose and the ear. Many, many rhinologists consulted and worked with orthodontists last year who never had done so before. Next year there will be many more. They realize that all cases of malocclusion and lack of development in the nose and arches, if taken in time to the orthodontist, can be made normal. In short, as one expressed it, that it is within the power of the orthodontist to mould, shape and develop the whole face according to his fancy.

Prevention and Early Treatment.

To meet these flattering expectations, however, it is necessary for the orthodontist to have the patient early, even before the arches have begun to malform, and by advice as to mastication, breathing and bad habits perhaps prevent malocclusion entirely. Or if the malformation has already begun, take the case as soon as it shows and correct it. By doing this early, the breathing can be corrected immediately, instead of being neglected for several years, and thus endangering the lungs and general health. Of course, the other features of malocclusion are doing harm, too, as long as they remain. A case of mesio-version was corrected by the writer at the age of sixteen months. It was done with an inclined plane in three days, and no appliance has been on the teeth since.

If a case of distoclusion is allowed to go uncorrected until the seventh, eighth, tenth or fourteenth year, the patient's masticating surfaces are one-half and sometimes one-fourth the normal, the bones of the face are growing abnormally, and most important and most dangerous, the mouth-breathing is continuing all this time, menacing the throat, the nose, ears and the lungs.

The rhinologist may see many of these cases before the orthodontist, and can work in unison with the latter in giving relief. In the Forsyth Dental Infirmary, every child that enters the institute passes through the hands of the rhinologist, the orthodontist and the dentist before being dismissed, and in each instance thorough examinations are made and charted.

Surely the dentist has come into his own.

A few decades ago dentists were striving for manual dexterity; some became wonderfully expert in manipulating gold foil, and they were always looking for opportunities to display their skill. Others boasted of their ability as extractors and seldom let an opportunity pass for displaying their operations.

Later that enthusiasm was modified, and the dentist began to keep a closer watch on his patients, so that the huge filling and the wholesale extractions were not necessary.

Arch Wire.

The orthodontists are passing through the same stages as the dentist. Angle's D bands and 16-gauge arches were the first great steps in simplicity of appliances. Next Ray D. Robinson attached pins to the wire and tubes to the bands to move molars and bicuspids bodily; then Angle came out with a .030 wire with pins and tubes for all the teeth. Robinson has since then introduced .022 wire for the same purpose, but with a different method of attachment. We are coming to a smaller arch wire; the .022 will be used more and more. These seem to be the most important steps as to appliances.

Dr. Stanton's Machine.

Dr. Stanton's machine for surveying the mouth and mathematically determining the least movement that will produce occlusion is one of the most scientific contributions to orthodontics within a decade.

The mechanical part of orthodontics seems to have made greater headway than the etiological and pathological features. So we are now beginning to dig more deeply into the causes that are constantly diverting the normal forces into the wrong channels, and we are wondering if we cannot really get at the very source.

Prevention of Malocclusion.

Now we are arriving at another stage of progress, that of prevention, and this step opens up the largest field that we have yet contemplated. We are looking from the effect to the causes that lie back of them. From the malaria, back past the mosquito, to the swamp; from the heart lesion and arthritis to the focal infection, and from the malocclusion back to the habits and environs.

This takes us into the field of preventative medicine, with its tremendous opportunities for mouth hygiene, and it puts us in the position to defend the whole body against the invasions that enter through the mouth.

The mouth is the place to fortify, for if we can prevent the enemy from passing here, there are not many other weak places where he can get by.

Dr. Billings, in a lecture before the Stanford University Medical School, made the statement that, excepting a few skin and venereal diseases, all the other diseases due to infection find their origin in the mouth and the nose.

This statement is proven by numerous writers in the medical magazines of the last year and a half. Case after case was traced to abscesses at the roots of teeth or to pockets. After the pus was stopped, many of the cases were entirely cured and nearly all were much improved.

The more progressive dentists have recognized for years that an unhealthy mouth means an unhealthy body. We have emphasized the necessity of normal occlusion, with its maximum grinding surface and proper breathing space, but until the last year or two we have felt that we are getting very little support from the medical profession.

I would not deny that there might have been some justice in the attitude of the medical profession toward dentistry, but the status of dentistry is improving and it will continue to improve in proportion to the demands made upon its professional attainments by the practitioners of medicine and the laity. You cannot expect your fellow-dentists to improve their conditions if you deny them the right to receive the same basic training and special work that you have had. Your assistance and co-operation is more to be desired than your criticism.

The daily papers, in reporting the Panama-Pacific Medical Congress, devoted more space to focal infections in the mouth than to any other subject. Pyorrhea and the emetin treatment was given page after page in the daily papers. Since then a number of physicians have been injecting emetin to cure pyorrhea and in some instances have sent the patient to a dentist with directions for the dentist to clean the teeth!

All this shows that pathologists are admitting that the mouth is the key to the health of the whole body.

The pendulum is swinging far toward dentistry. Be conservative in your judgment as to all the statements that are made regarding the relation of the oral cavity to disease. Sometimes people with a complete denture of sound teeth and a healthy mouth die prematurely.

Summary.

In summarizing the recent development in orthodontics of interest to the rhinologist, I may say:

1. That while the oral cavity as a source of infection is commanding the attention of the medical profession, to a large degree it has relatively little bearing in the field of orthodontics.

2. That while our science is largely technical and mechanical, and yours is largely surgical, yet we are dealing in general with similar structures very closely related, and we should endeavor to bring about conditions in our medical and dental schools whereby those who expect to specialize in either profession may have the opportunity of gaining some knowledge of the other fellow's point of view. This plan is now being inaugurated at Harvard and McGill Universities.

3. That in undertaking preventive work we should see our cases as early in childhood as possible and should, therefore, be in close touch with the pediatrician in order to do so, and

4. That the rhinologist is in a position to determine the probable necessity for orthodontic treatment by making a few clinical observations which may be of great benefit to the child.

I wish to acknowledge assistance rendered by Dean Guy Millberry.

The Use of the Plain Band for Molar Teeth.

By C. A. Hawley, D.D.S., Washington, D. C.

The security of anchor bands has been one of the most important problems in the technique of orthodontia. Its development has been concomitant with the development of that most efficient appliance in the art or orthodontia, the expansion arch. The weakness of the anchorage or attachment to the molar teeth was the predominant weakness of the early forms of the expansion arch or "long-band" used by Frochard, Shange, Fox, Harris, and others. (Fig. 1.)

Farrar improved the stability of the appliance by encircling two or more teeth with the screw band (uncemented), and much improved the efficiency of this appliance. (Fig. 2.) When plain bands cemented to the teeth were devised by Magil, great improvement was made in the stability of anchorage, but these bands applied to the molar teeth with the technique then used developed weaknesses which were overcome by the clamp band as perfected by Dr. Angle. The clamp bands, as made by Dr. Angle and some few modifications made by others, are the most extensively used in orthodontia to-day of any forms of anchor bands, but have some serious objections.

Objections to Molar Clamp Bands.

1. The bolt and nut on the lingual surface, used to draw the band together, is irritating to the tongue, and by its size and unevenness causes the formation of pockets for lodgment of food and débris between the tooth banded and the adjacent tooth.

2. The attachment of the bolt and short tube to the band is weak and often gives way under stress.

3. The free edges of the band turn back under the impact of mastication. If the bolt and tube are placed at the gingival edge so as to draw the band tight at the margin, this danger is increased.

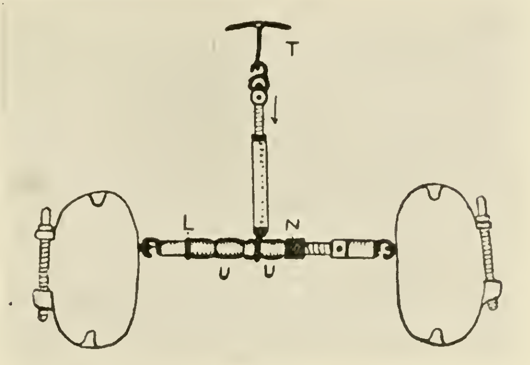
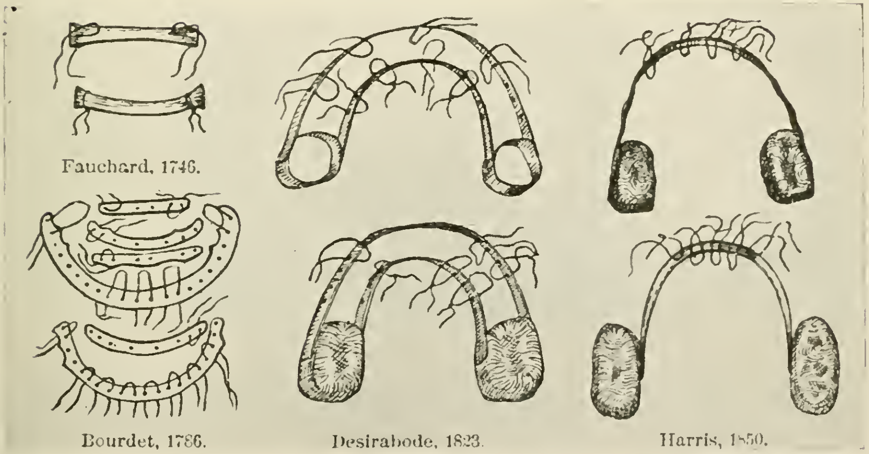


Fig. 1.



Fauchard, 1746.

Bourdet, 1786.

Desirabode, 1823.

Harris, 1850.

Fig. 2.

4. The uncovered portion of the tooth on the lingual surface is a source of danger and weakness, and if the band is so made that the edges lap, it is thick and clumsy.

5. It also prevents the use of the vertical tube on the lingual surface; a most valuable form of attachment of the lingual arch.

The form of clamp band that has the bolt on the buccal surface has two serious objections.

1. If the band is fitted to the tooth in the best position, the direction of the tube is often not correct and cannot be quickly and safely changed.

2. No other attachment than the hollow bolt can be made on the buccal surface.

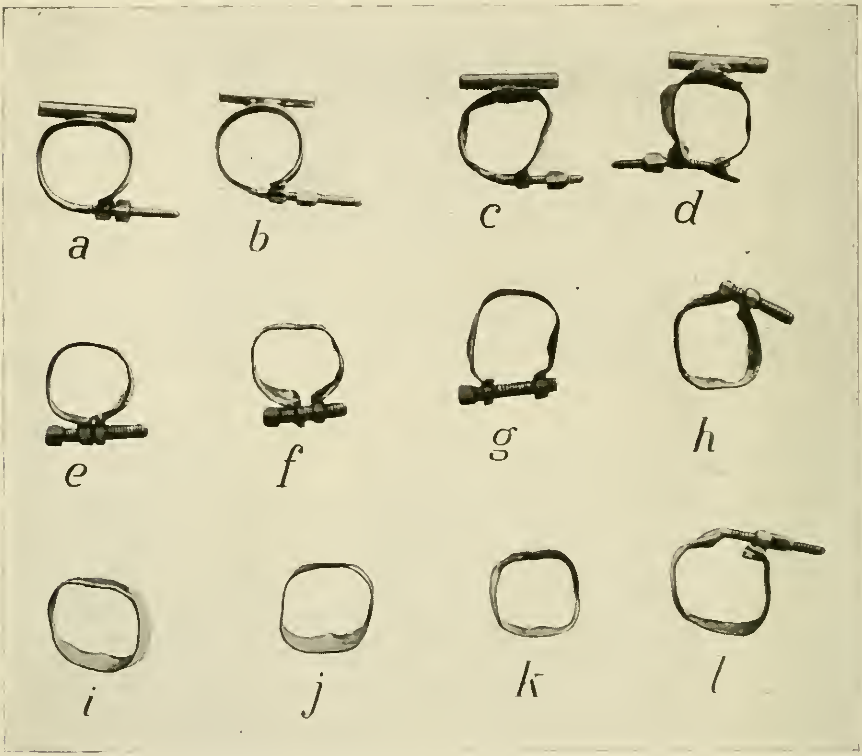


Fig. 3. a and b Angle clamp bands which have never been fitted to a tooth. c, d, e, f, g, h, and 1 clamp bands of various styles that have been used in treatment showing their conformation to shape of tooth. i, j, k plain bands that have been used in treatment showing adaptation to shape of tooth.

The claim for clamp bands that they can be tightly drawn about the neck of the tooth into accurate fit and contact, thus maintaining their stability without dependence upon cement, is true and constitutes a good and valid argument for their use. (Fig. 3.)

After ten years' use of clamp bands I abandoned them four years ago, and for three years have not used a single band of that description. For the first year I kept a stock of parts of clamp bands, expecting to find some teeth so difficult to fit that a plain band would not be successful, but in three years I have not found such a case.

Shapes of Molar Teeth.

The success of this band, where formerly it was a failure, depends upon an improved technique and recognition of certain facts concerning the forms of molar teeth. In regard to the form of the molar teeth it is a fact that the circumference of the tooth at the marginal ridge or contact point is practically the same as at the gingival margin, though of different shape. The widest diameter at the contact point is mesio-distally, while at the gingival margin it is widest bucco-lingually. So in passing over the tooth a flexible band, the band spreads out mesio-distally in passing over the contact portion, but as it is pressed down over the tooth it spreads bucco-lingually and draws in mesio-distally so that when in position it accurately fits the tooth and is accommodated to the exact tooth form at the neck or gingiva. I wish to emphasize the word *flexible,* for if the material is too stiff or has been stiffened by solder on the mesial or distal surfaces the band cannot be properly fitted. (Fig. 4.)

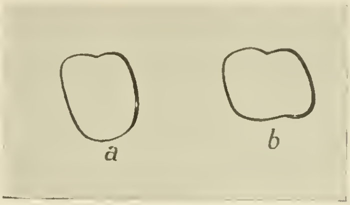


Fig. 4. a—Outline of upper molar tooth at the gingival portion encircled by a band. b—Same at the occlusal portion.

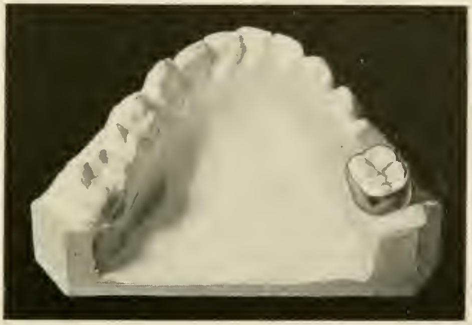


Fig. 5.

Construction of Bands for Molars.

Material for permanent molar bands should be six-thousandths of an inch in thickness. Material for temporary molars may be five-thousandths of an inch in thickness. It is not practical to pinch material of this thickness around the tooth in the manner that bands are pinched for incisor teeth. Clamp bands are usually seven-thousandths of an inch in thickness, the extra thickness being necessary for strength at point of soldered bolt and short tube.

The technique of making these bands was first developed by Dr. Henry Baker, and is as follows:

A good model of the tooth to be banded together with the adjoining teeth is obtained. With a fine saw cut vertically between the teeth and then diagonally from the adjoining teeth, opening a V-shaped space at the mesial and distal surfaces. This cut should be deep enough so that band material two-tenths of an inch wide can be placed over the tooth and be in proper position at the occlusal marginal ridge. With a sharp instrument carefully trim the tooth to the actual size and form of the crown in the mouth. (Fig. 5.)

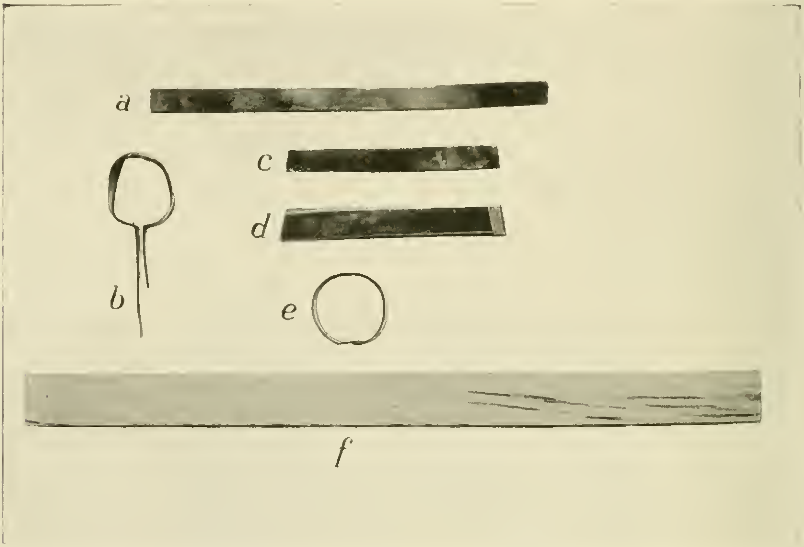


Fig. 6. a—Copper strip. b—Same after pinching. c—Same cut at groove. d—Same laid on band material which is cut enough longer to make the lap joint. e—Band after soldering. f—Wood stick used to press band over tooth.

This plaster tooth is now measured with wire or copper strip (the writer prefers a copper strip), the band material cut and soldered with a lap joint and the band fitted and burnished to fit the model. (Fig. 5.)

Dr. Baker advises painting the tooth with shellac containing powdered rouge to give it color. After the shellac is dry, paint with sandarac. This defines the gum line and indicates how far the model is trimmed

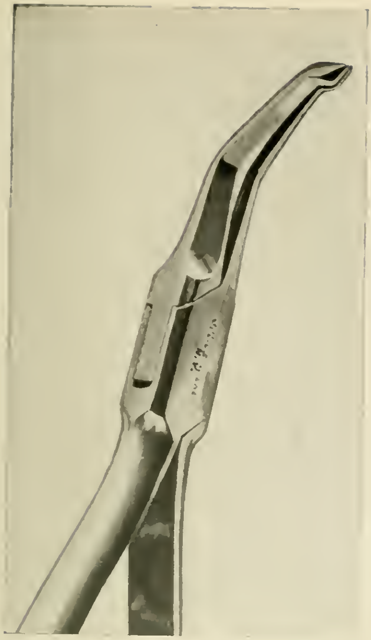


Fig. 7.

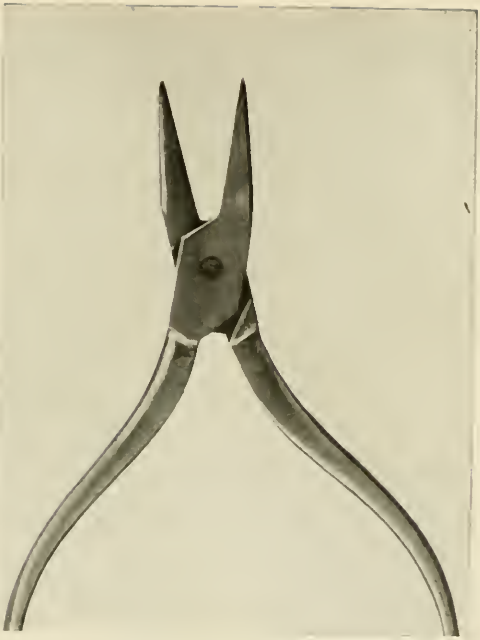


Fig. 9.

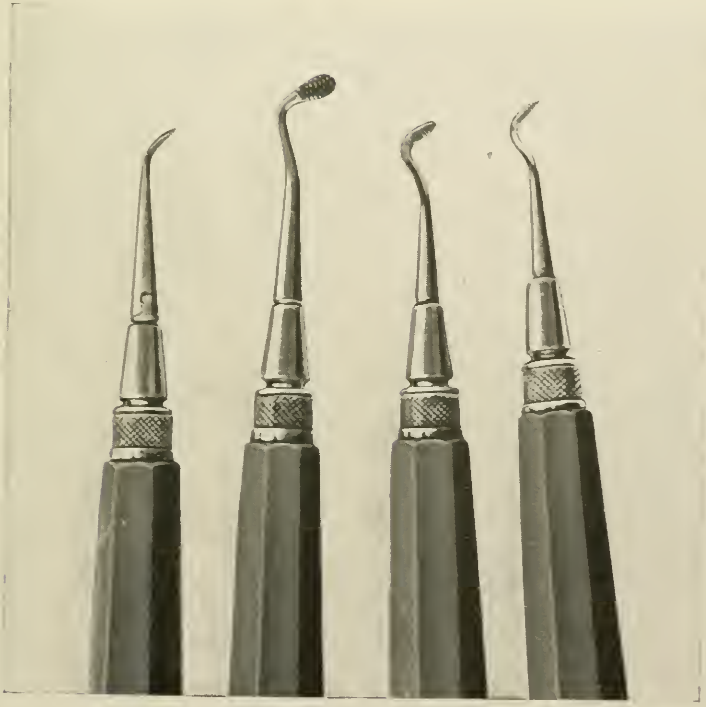


Fig. 8.

below the gum line. He then takes an impression in mouldine, makes a fusible metal die and swages the band over this die.

After previous separation of the teeth, the band is carried to place in the mouth. After a little experience in trimming the model, these bands will be found to fit accurately and rarely require reconstruction.

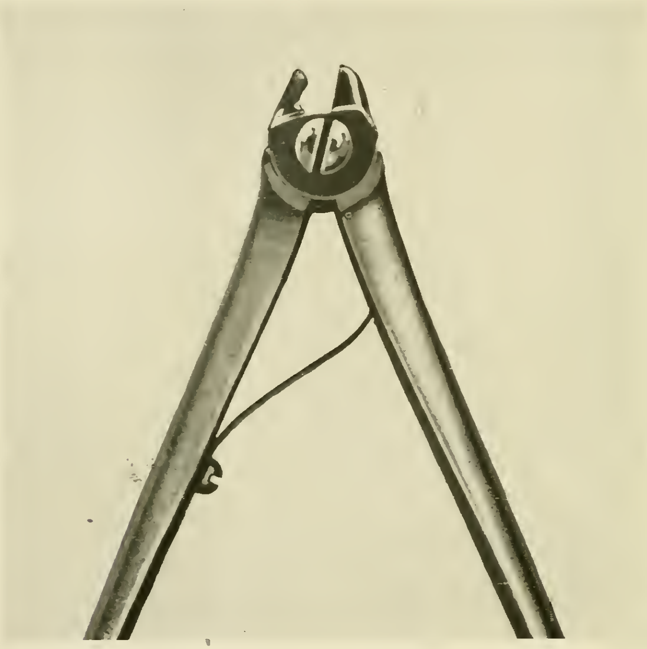


Fig. 10.

A great advantage of this technique is that the bands may be made by an assistant in the laboratory. This technique may be modified, if desired, by fitting the band directly in the mouth.

Technique for Fitting in the Mouth.

When working directly in the mouth, the writer uses for measuring a copper strip two and one-half inches long, fifteen-hundredths of an inch wide and three-thousandths of an inch thick. (Fig. 6.) A convenient instrument for pinching the strips on the buccal or lingual surface is shown in Fig. 7. A hickory stick is useful in pressing the bands over the tooth in the mouth. Serrated burnishers are valuable in fitting the band at the occlusal and mesial and distal gingival margins (Fig. 8.) A pair of narrow beak pliers are also valuable to draw in the band at the margins (Fig. 9), and band-stretching pliers occasionally to contour or stretch the buccal margin. (Fig. 10.)

Bands Ready Made. As suggested by Dr. Pullen, a stock of bands may be made up that will include all the usual variations of the molar teeth—from about one hundred and thirty-two to one hundred and forty-eight hundredths of an inch in length—one hundred and forty-two hundredths being the average. The proper band can be quickly selected and fitted directly in the mouth. A band can be made and fitted by this method in about the time generally consumed in fitting an Angle clamp band.

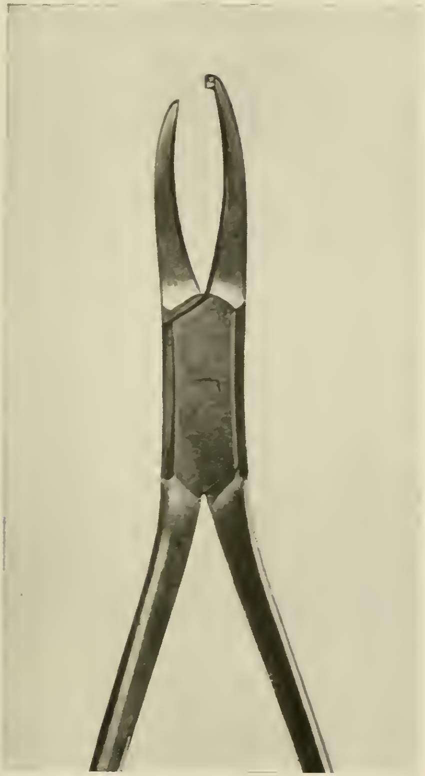


Fig. 12.

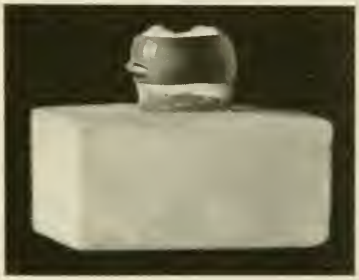


Fig. 11.

An important item in the use of plain molar bands is their quick and safe removal. This is accomplished by soldering a wire lug on the lingual surface just above the gingival margin and using a Case band remover. With this instrument they can be very quickly and safely removed. (Fig. 11 and Fig. 12.)

Two objections have been raised to the plain molar band. First, that being held only by cement, it cannot be made as secure. Second, that the mesial and distal portions will impinge on the gum and cause irritation. In my own experience, neither of these objections has been found valid. They have proved more secure than clamp bands, and while held by cement the cement has proved adequate under all circumstances.

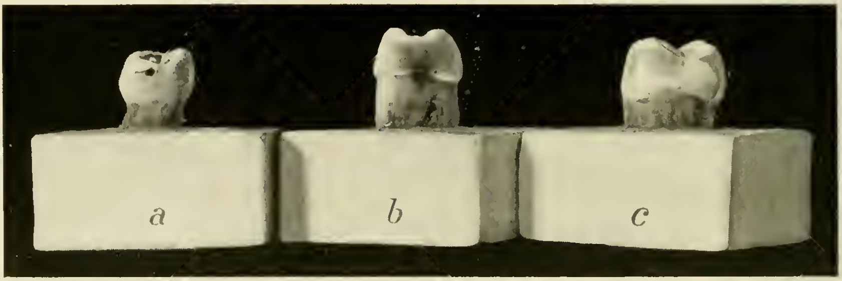


Fig. 13. Photograph from side of (a) deciduous lower molar; (b) upper first permanent molar and (c) lower permanent molar showing difference in shape.

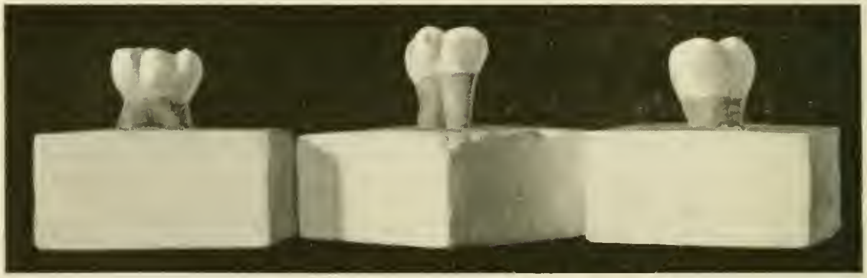


Fig. 14. Same as Fig. 13 except taken from the buccal surface.

If properly fitted they do not irritate the gums, in fact, are less irritating than clamp bands, and can be passed as far under the gum margin without irritation.

In an article in the *International Dental Journal,* February, 1915, by Dr. Dewey, a number of statements are made that are so opposed to my own experience and observation that I cannot leave them without comment. He says: "It must be remembered that plain bands are held in place only by the adhesion of the cement to the tooth and the band; therefore, it would be considered poor mechanical judgment to use the plain band when intermaxillary anchorage is employed."

While admitting that the plain band is held only by cement, yet the writer has found, as stated above, that the cement is sufficient in all cases. In fact, my experience would indicate that well-made and fitted plain bands are far more secure than clamp bands, owing to the defect of the open space caused by the bolt. At least, fewer of them give way during treatment, and intermaxillary anchorage can be freely used without danger.

Again he says, "The greatest circumference of a deciduous molar is at the gingival margin." "The circumference of the band at the occlusal border is smaller than at the gingival portion, as a result of which a plain band for the deciduous molar will fit more accurately than a plain band for a permanent molar."

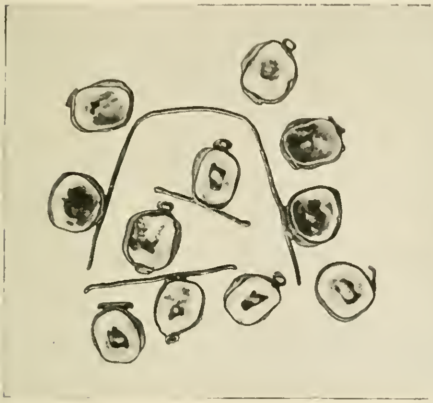


Fig. 15.

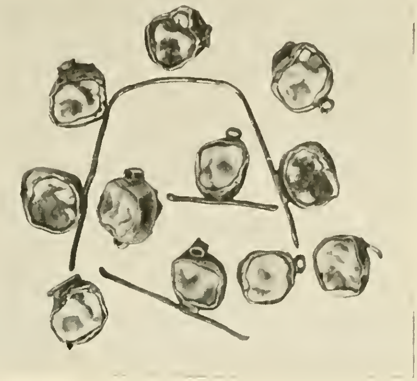


Fig. 16.

Fig. 15. Deciduous second molars that have been banded with plain bands and remained in the mouth until the roots absorbed.

Fig. 16. Same as Fig. 15 from occlusal surface.

In Figs. 13 and 14 we have an upper deciduous molar and two typical upper permanent molars, shown from the buccal and mesial aspects. In the deciduous teeth, the occlusal circumference at the point encircled by a plain band exceeds the gingival circumference by from five to eight one-hundredths of an inch, and in the permanent molars, the occlusal circumference exceeds the gingival about three one-hundredths of an inch. These measurements bear out my observation and experience that deciduous molars are the hardest teeth in the mouth to fit with a plain band. The deciduous teeth are the only ones in the mouth that can be examined out of the mouth after they have been banded, for often the roots are absorbed and the crowns removed with the bands in place. A collection of such teeth are shown in Figs. 15 and 16. While some of these bands do not fit perfectly, yet they served their purpose with less irritation of the gums than any other form of band with which I am acquainted.

In regard to materials, the writer prefers iridio-platinum. It has the necessary elasticity and can be soldered with pure gold and the attachments made with 22K plate, thus preserving its elasticity and adaptability to the greatest extent. In unusual forms of teeth iridio-platinum bands can be slit, lapped and soldered with pure gold without materially stiffening the band or injuring its smooth surface. If required, the joint can be opened and the band made smaller or larger with safety, thus allowing any correction in the measurement that may be advisable.

Discussion of Dr. Hawley's Paper.

Dr. J. Lowe Young. I have used the plain bands for molars a number of years. I use them exclusively, and I find they are in my hands far more successful than clamp bands. I will make a statement that may surprise you. I claim that a man cannot make a perfect fitting plain band on a molar! The shape of the tooth, as shown by Dr. Hawley, is smaller at the gingival border than at the contact point, and the thing that goes into a thing must be smaller than the thing itself. But it may be made such a good fit that there is far less irritation to the soft tissues than with the clamp band, owing to the bolt and nut that it is necessary to use with the clamp band. If somebody would devise a band that can be drawn around a tooth and held there without that cumbersome bolt and nut we would have a still better proposition. But the plain band, after years of use (I have used it five or more years), is, in my hands, far better, far more stable and less liable to cause irritation to the adjoining soft tissues and to the tongue. I have had a number of mothers remark to me where I have treated several of the family, using for the first patient probably clamp bands and for the other members of the family plain bands: "I could not think there would be such an improvement. The child does not complain at all after the bands are put on."

I do not know the custom of the men using clamp bands. I never have put but one in the mouth at one sitting. I put that on and expected the patient to worry along and get the tongue sore and get accustomed to it and get over it. The patient had four experiences of that kind. I would not hesitate to put on four plain bands at one time, and it does not annoy the patient one-tenth as much as one clamp band.

In trimming the model for this band I tell the laboratory assistant that the plaster model is to be trimmed down to a sufficient depth to take a band 20-100 in. in width, and that the tooth is to be kept full size at the gum line, and I find by doing that that those bands practically all will go into place and fit.

There is one thing I have found in the use of these plain bands: that just as surely as the patient complains of a band being *too tight* when you put it around the tooth, it is *too loose*. You cannot force a band over a tooth tight enough to cause irritation, but if too big it encroaches on the soft tissues and feels tight. Do not stretch it, but take it up. If it feels too tight it is too large.

The contour pliers, Dr. Merchon has been successful in having the S. S. W. make, I have found to be of great advantage in bending the bands, particularly on the side that is soldered. I have made it a practice of putting the seam of the plain band on the upper molars on the lingual side; on the lowers, on the buccal side. That is why the band is cut longer on the gingival edge of the band than on the occlusal. Then the band is cut away on the mesial and distal surface (festooned) and the gingival border is crimped in, and if that is done carefully and the band made as Dr. Hawley has said, of springy material, a very good fitting band can be made.

I have heard criticisms of the plain band, and I admit it will cause irritation in the hands of a careless workman. That can apply to anything. I have seen clamp bands so placed in the mouths of children on the upper molars that the screws almost touched each other across the palate. That is not the way to fit a clamp band, but that is how they are fitted by careless people, and that is no argument at all.

Dr. Hawley said in his paper, as I remember it, that a plain band could be fitted in about the same length of time a clamp band could be fitted. It is perfectly safe to say it could be fitted in one-tenth the time in which the clamp band can be fitted. If the plain bands are made on good plaster casts (and I might say for a number of months I have been using a plaster made by the Detroit Mfg. Co. that is extremely hard, and you can work on it almost as if it were a fusible metal tooth), they can be fitted and pressed to place in a very few minutes. All that is necessary is to use a piece of hickory to press the band over the tooth, without contouring, and if it goes over the tooth and the patient does not complain of a tight feeling, take it off and crimp in the gingival border cement to place and it is done. I would not use clamp bands if given to me without cost.

Dr. Ralph Waldron. I differ in my technique in making bands quite a little from Drs. Young and Hawley. My experience has been about the same as Dr. Hawley, inasmuch as I have never found a great deal of difference in the measurements of the circumference of the teeth at points of contact and gingival margin. I advise a technique which I will explain. I use two different kinds of band materials. One is of platinum and gold, which I get for the permanent molars: it is 10 parts platinum and 90 parts gold. It has more or less spring to it. For deciduous molars I use a metal which is 10 parts palladium, 10 silver and 80 parts gold. One is soft and the other has considerable spring to it. I use a copper strip to measure the tooth at the point of contact, and have three mandrels, tapering from the thinner portion to the thicker, the same as a jeweler would use for rings. After measuring the strip I bend a piece of band material at right angles, and then place the band metal on the mandrel. Bend at the other end also at right angles and pinch the band and force it against the mandrel and get a square joint. With 20 or 22K solder, join the ends together. I never lap the joint and have never had one open. I use Pullen's band adapter and like it better than the piece of wood. The wood looks unsightly. This instrument of Dr. Pullen's does not slip, and will force the band down as far as you want it. With an excavator or explorer I mark around the gingival line, and thus indicate what is to be trimmed off. Remove the whole band, and with Case's contour pliers contour the band to have a slight crescent shape on the outside. It will then hug like a Jackson Crib and go right down to place, and it needs very little burnishing.

Dr. Ottolengui. When I first joined this Society I was told I would have to give up plain bands to be up to date. So I gave them up! Now, last year I found I was five years behind the times because I was not using plain bands. So I have been gradually getting back to my old methods as fast as I could collect the clamp bands off the teeth already under treatment.

The technique described here is practically the same as was taught me by Dr. Kingsley. If the experts have all come to the conclusion that the plain band is the band they like, let us make it correctly. Dr. Young said it was impossible to make an absolutely correctly fitting band where the molar is smallest at the gum line, and as it is pleasant to tell a man how to do a thing that is impossible, I shall endeavor to do so.

I use seamless gold bands. Let me now describe the technique for fitting a band to a molar when the diameter at the gingival margin is smaller than the diameter at the contact point. I want Dr. Young's attention, as we need a good pair of pliers, and he is the man for making pliers. A proper band that will just go over the contact point is selected. I work directly in the mouth. Press it down over the tooth and into place with the Pullen band adapter. When pressed down and burnished to place it will very likely leave a wrinkle along the occlusal edge. On the lower molar it is advisable to bring this wrinkle at the disto-buccal corner. That can be pinched tight with a pair of pliers; take off, use a drop of solder, cut away the excess, and you have a nice contour to fit over that portion of the tooth. Next, to obtain a fit against the neck which is so much smaller. Burnish till the excess is at the mesio-lingual corner. A pair of pliers is used after the burnishing is done to pinch the excess of the band to that point near the gingival edge, and it is pinched absolutely tight, drawing that edge of the band to a fit. That leaves a fold, but the band is now tightly fitted, and were it not for the fact this wrinkle will open you could not get it off. The band is slowly forced off, doing which you open this fold. When you cement the band into place, let a little cement go into the wrinkle. When down in place, pinch tight, turn it over and fold it back against itself, and it is perfectly tight and never slips up.

One other point. The plaster Dr. Young speaks of is very nice, but very slow setting. If you want something on which to fit bands out of the mouth, I would suggest the use of Ames' Technic cement. Use it of about the consistency of putty; put a little talcum on it and press it into the impression.

Dr. Lloyd Lourie. There is one point I wish to mention which is of importance in regard to the comfort of the patient while the band is being fitted, and that is the trimming of the gingival edge of the band that passes through the interproximal space. This is particularly necessary when the bands are being fitted in the mouth. When untrimmed band material is used it is pushed beyond where it should go into the interproximal spaces and is often painful to the patient and injurious to the soft tissues. I bend the band material into a loop and then trim off the portions that go into the interproximal spaces before putting the band on the tooth at all, and know the patient is saved much discomfort, and the band does not run as far into the interproximal spaces and is not so liable to injure the soft tissues. The band can also be placed higher buccally and lingually and avoid leaving space between its gingival edge and the gum margin, which space is difficult to keep clean and invites softening of the enamel.

A practice that has saved lots of annoyance with the occlusal edges of these plain bands loosening is the re-enforcement, with solder, where burnished into the buccal or lingual grooves at the occlusal edges.

Dr. G. W. Grieve, Toronto. I appreciate very much the paper of Dr. Hawley and the discussion of others. I follow pretty much Dr. Hawley's technic. I would like to ask if these men do not make a difference in bevel of the bands for different teeth, to do away with the matter Dr. Ottolengui speaks of? I am trying to train my assistant to judge from the model the slope of the different teeth she is going to band, and by varying the slope in accordance with the tooth being banded, to do away with any possible crimping. I make quite a difference in the slope of the different bands.

Dr. Young. I do not think Dr. Grieve got Dr. Ottolengui's idea. Dr. Ottolengui puts the crimp in the gingival edge of the band, not in the occlusal.

Dr. Ottolengui. I think Dr. Grieve is speaking here of my crimping along the occlusal edge. This is made necessary by my use of continuous bands, which, of course, have a uniform diameter. Dr. Grieve is correct, but the continuous band avoids the seam on the lap joint, and is more easily burnished.

Dr. Frank Casto. There are one or two things in Dr. Hawley's paper of which I wish to speak. I follow very closely the technique described by Dr. Hawley in the construction of plain bands for the molar teeth. Using the same type of pliers, burnishers, etc., I differ somewhat in the construction of the bands for the lower molars. Instead of making the joint on the buccal side of the tooth, I make it on the lingual side, that is to say the band is soldered on the lingual rather than on the buccal side. After the band has been fitted upon the tooth, I place a burnisher between the band and tooth on the buccal side, and force the band material buccally. This will tighten the band around the tooth. The band is then cut in one or two places from the occlusal toward the gingival about half way down. The band material is then burnished to the buccal side of the tooth. The band is removed from the tooth and solder is flowed inside the band on the buccal side. This connects the parts that have been cut as well as to strengthen the band. The manner in which plain bands are removed from the molar teeth is quite important. The lower bands should be removed by bringing pressure upon the buccal side, because of the contour of the teeth, and the upper molar bands should be removed by bringing pressure from the lingual side. I have found the Case or Pullen band removing pliers to be quite efficient for this work. I agree with Dr. Lourie, and wish to further emphasize the fact that it is quite necessary to festoon the bands upon the mesial and distal side. The periodontists have proved the fact that if the dental ligament is injured, that is, if the fibers of the dental ligament are cut in the fitting of bands upon the teeth or the use of ligatures, it will never heal or repair itself. Therefore, carelessness by the orthodontist in this respect may be the cause of incipient pyorrhea later on. The periodontists claim that such cases have come under their observation. In regard to cleanliness, there is no question but that the plain band can be kept clean more easily by both the orthodontist and patient, than can the clamp band. Some persons have spoken of the difficulty in fitting plain bands upon the teeth so that they will be strong enough to withstand the pressure applied by the use of the appliance. I have experienced no such difficulty in my own practice, nor do I think any person will if they follow the technique as described by Dr. Hawley. I think that plain bands can be fitted in more difficult cases than can clamp bands.

Dr. Martin Dewey. As to the matter of deciduous molars. We speaks of the circumference at the occlusal border and at the gingival border, and we do not mean the neck of the tooth root. The occlusal circumference is less than the gingival circumference. I think a gentleman several years ago wrote a *Dental Anatomy;* his name was G. V. Black, and he tells us that the occlusal diameter is less than the gingival diameter.

Dr. Bert Abell. I have not heard anyone say they have used anything but a plain strip of the same width. I would like to know if anyone has been cutting the band material from a wide strip of material and cutting to a copper pattern? Take a band of copper and form it into exactly the shape to fit the tooth and not impinge on the soft tissue. By using a wide strip and laying the pattern on it, it may be marked and the joint made on the inside, away from where you want to solder, and you will have a band almost the shape of the tooth. There will be very little waste material if you mark the surfaces around at the top of the tooth and get the pattern as you want it.

Dr. F. A. Delabarre. It was my good fortune when I started the practice of dentistry to be associated with Dr. Ainsworth, of Boston, who has done more or less in the line of orthodontia. From him I got not only my inspiration, but my technic very largely. It was his practice to make plain bands, and I think he never has used the clamp bands, and his method of making them is much as has been described here to-day, except in some of the minor details. One point I have from him in making them on plaster models is to varnish the model with shellac before any trimming is done. That gives a colored surface, and then he saws down between the teeth and trims below the gingiva, as shown on the plaster model, that shows up a white line and allows you to gáuge the distance you force the band down below the gum margin so you can made it uniform, and you do not make is wide enough to impinge on the gum attachment under the margin.

Dr. Kingsbury. I think my method of making these plain molar bands is somewhat different from that which Dr. Hawley has described. The main difference is that I cut the band material perfectly square where it is lapped, instead of slightly slanting. I believe that a better fitting at the gingival margin can be obtained in this way, and a more secure grip on the whole tooth. If the diameter of the average molar is the same at the gingival margin as it is at the point of contact, there would seem to be nothing to gain by any departure from the absolutely cylindrical form as a pattern for the band in the preliminary stage before you begin to adapt and contour it.

In contouring and adapting these bands I use a pair of pliers which are catalogued as Dr. Lane's contouring pliers. I will show them in the clinic to-morrow. They are very useful also in contouring plain bands for the anterior teeth if you are using rather wide festooned bands for the pin and tube appliances.

Dr. F. C. Kemple. Dr. Pullen and I have a little variation from using what Dr. Ottolengui describes as a seamless band. Bands are made up in cylinders varying in size perhaps 1-100 in. and the proper collar is selected, the one most nearly fitting the tooth we are intending to band, and after fitting it around the tooth, festooning it, crimping it, etc., as a final step in the operation I pinch a little fold in the band near the occlusal surface, drawing the band very tight around the tooth, giving it a very accurate fit at the occlusal edge. I am satisfied that is better than any of the methods described here.

Dr. Hawley. I do not think there is anything I wish to comment on. The discussion has been on minor points of detail, and I have not heard anybody attack the main proposition that the plain band is better than the clamp band.

In regard to the slanting joint or square joint, it is a matter of practice. If you pinch the band in the mouth, using a copper strip, you have a straight joint. Dr. Kingsbury is right, that the band which is fitted on a tooth hurts the gingival margin. With iridio platinum I make a straight band and can cut and manipulate it better than any material I have seen.

There is the point of the possibility of fitting deciduous molars that I have not heard discussed very vigorously. I think all the deciduous molars I have banded are smaller at the gingival margin. I think if I remove these bands and slit them and lay them out on a piece of paper the gingival margin would be the shorter.

The Records of an Orthodontist.

By B. E. Lischer, D.M.D., St. Louis, Mo.

When the art of correcting oral deformities became a specialty a new epoch was inaugurated because, beginning with that moment, a new group of workers assumed very definite tasks and obligations. Many of you may recall the earnestness which characterized your enlistment, the high ideals with which you visualized a goal worthy of your very best efforts, and the noble enthusiasms which presaged such a desirable increase in the accumulation of recorded facts.

Contrast with that innocent, though worthy vision of the future, your present conception of the many problems which confront us on every side; recall for a moment the rapid rise and fall of the countless theories, methods, systems, schools of thought, etc., with which our literature abounds, and with which every student of orthodontic history is familiar. Such fleeting changes in the early development of an art are perhaps inevitable; they apparently are symptoms of immaturity. On the other hand, a review of great constructive movements, of substantial progress in methodology, of all real advances, invariably impresses one with the fact that they are *based upon scientific methods of inquiry.*

It is not very pleasant to observe that orthodontic literature can boast few classical contributions to knowledge. A review of all the texts would not reveal a single chapter which would favorably compare with Thomas McCrae's chapter on *Typhoid Fever* (Volume II of Osler's "Modern Medicine"), which is "based on the experiences of the Johns Hopkins Hospital Series of 1,500 cases and 105 autopsies."

It is also a very great misfortune that our colleges have not only failed to standardize their clinical records, but are seemingly oblivious to their great scientific value. And the profession, too, has failed to grasp the grand opportunity offered by the recent extension of dental service into many of our public schools. Indeed, one need only reflect for a moment on such facts of our existence as dental caries, affections of the pericementum, oral deformities, their relation to health, etc., to become conscious of a very serious deficiency in accurate and pertinent data. And when we recall the examination blanks and record cards in use in college clinics (at least during our student days), we may well marvel how we ever escaped with even a taste for science.

I. The Method of Science.

The goal of science—a complete interpretation of the universe—may never be attained; but "the task of science can never end till man ceases to be, till history is no longer made, and development itself ceases." Hence it follows that "the smallest group of facts, if properly classified and logically dealt with, will form a stone which has its proper place in the great building of knowledge, wholly independent of the individual workman who has shaped it. And this great structure, the proportions of which are beyond the ken of any individual man, possesses a symmetry and unity of its own, notwithstanding its haphazard mode of construction. *This symmetry and unity lie in scientific method.*"

"The scientific man has above all things to strive at self-elimination in his judgments, to provide an argument which is as true for each individual mind as for his own. *The classification of facts, the recognition of their sequence and relative significance is the function of science,* and the habit of forming a judgment upon these facts unbiased by personal feeling is characteristic of what may be termed *the scientific frame of mind.* The scientific method of examining facts is not peculiar to one class of phenomena and to one class of workers"..........."and we must carefully guard against supposing that the scientific frame of mind is a peculiarity of the professional scientist."

Orthodontics is of dental origin, was first nurtured by dental practitioners, and though it is a crowning achievement of the dental progress of the last generation, it is still in its infancy. And in the realm of the remedial arts even dentistry has not yet attained that perfection and esteem which it merits.

Our constitution declares: "the object of this society is to promote orthodontia as a science, and as a distinct dental specialty." Now it is obvious that every scientific advance will strengthen the art as a specialty, and every specialty, ultimately, rests upon the service it renders to society at large.

But if we reflect for a moment on the great number of facts which daily come under our observation, it appears doubtful whether we are taking advantage of our opportunities. I have already intimated that when we entered the ranks as specialists we assumed certain obligations; and one of the most important of these, it seems to me, is to record the great mass of facts which fill the routine of our daily tasks. Are we doing this to the best of our ability? I hesitate to answer because, unfortunately, I am compelled to say *no*.

II. Essentials of Orthodontic Records.

It therefore seems eminently worth while to discuss the methods generally employed in keeping office records, to suggest a routine which reduces difficulties and details to a minimum (because the latter are always irksome to the busy practitioner), and compile an index which will greatly promote their usefulness.

It is not at all unusual for an average practice to extend over a period of from thirty to forty years, thus affording ample opportunities for the compilation of valuable data on which scientific deductions and advances in the methods of treatment can be based. It is exceedingly important, therefore, that every practitioner should adopt some definite plan for the keeping of records; and he should exercise sufficient precaution to make them accurate, concise and practical. When they comply with these requirements their value can hardly be overestimated. They should be designed to provide for the special needs of an orthodontic practice, which may be briefly enumerated as consisting of *written records,* of *plaster models,* of *photographs* and *radiographs,* and such illustrations, drawings and appliances as may be worth recording.

III. The Written Record.

When the writer entered the practice of orthodontics he was unable to find a description of any practical plan for keeping office records. His previous experience as a dentist had taught him the value of accurate records and gave him the opportunity to familiarize himself with the various methods then in vogue among dentists. These usually consisted of a day book and ledger, or a day book and record card with diagrams of the teeth.

The growing popularity of the card system and the numerous methods, for indexing card records, prompted the writer to adopt it in his orthodontic practice. At first a very simple card, 5 x 7 inches in size, was designed for this purpose. Since then, the size and design have been revised three times, and the following suggestions are based upon the design employed at present. The complete written record consists of an appointment book, examination blank, record card, numerous blank cards for the index, and the various guides used for their classification.

(a) The Appointment Book.

The appointment book is a Standard Diary No. 356, which is bound in cloth and contains a page for every day in the year, a calendar, etc. On the Sunday pages, appointments a month or more apart are entered. On the Saturday preceding a Sunday-page appointment a notice is mailed to the patient (or parent) reminding him of the appointment for the week following. Patients under active treatment, whose appointments are usually a week apart, are entered upon the page bearing the exact date. Patients having a special appointment, i. e., one for which a considerable time allowance is made, are provided with a card upon which the exact date and hour are entered, at the time the appointment is made. This card has a foot note requesting due notice if the appointment can not be kept.

At the end of the day the services rendered each patient are entered in ink on the page for the day and immediately adjoining the patient's name. The following morning these items are entered upon the record cards by the secretary. All broken appointments are also entered at this time, but in red ink. As previously stated, the appointment book is substantially bound in cloth and the one objection which the courts have frequently raised against record cards is thus removed.

(b) The Examination Blank.

The examination blank is a printed form of regular letter size (8½ x 11 inches), printed on light stock, and blocked in blocks of 100 sheets. Fig. 1. It contains all of the questions to be asked during a consultation, memoranda of the present condition of the patient, the probable cause of the deformity, as well as the diagnosis, remarks as to the prognosis and treatment, etc. The answers to the questions and all other notations made at the time of consultation are subsequently transfered to a record card by the secretary.

(c) The Record Card.

The record card is similar in size and design to the examination blank, but is printed on very substantial white stock, Figs. 2 and 3. The front of this card presents the case number and all the facts of a purely scientific interest compiled from the examination blank and the subsequent treatment of the case. The names of the patient, parent and references, together with the record of the treatment, are entered on the back of the card. The classified index employed by the writer for the classification of the facts gathered in this manner will be described later.

Name

Parent

Residence

Telephone

References

Vocation

Remarks:

HISTORY

Has the father normal teeth?

Has the mother normal teeth?

Were the father's teeth treated?

Were the mother's teeth treated?

Facial form of parents:

Father

Mother

Have any relatives abnormal teeth?

Have you had any serious illness?

Recurrent attacks of colds?

Any operation on nose or throat?

Bronchitis?
Rashes?
Eczema?

During infancy how was patient fed?

Were pacifiers used?

How old when beginning to walk?

How old when temporary teeth appeared?

How old when permanent teeth appeared?

Note Habits

PRESENT CONDITION

Age

Sex

Voice

Vision

Hearing

Height

Weight

Oral Health

Nose and throat

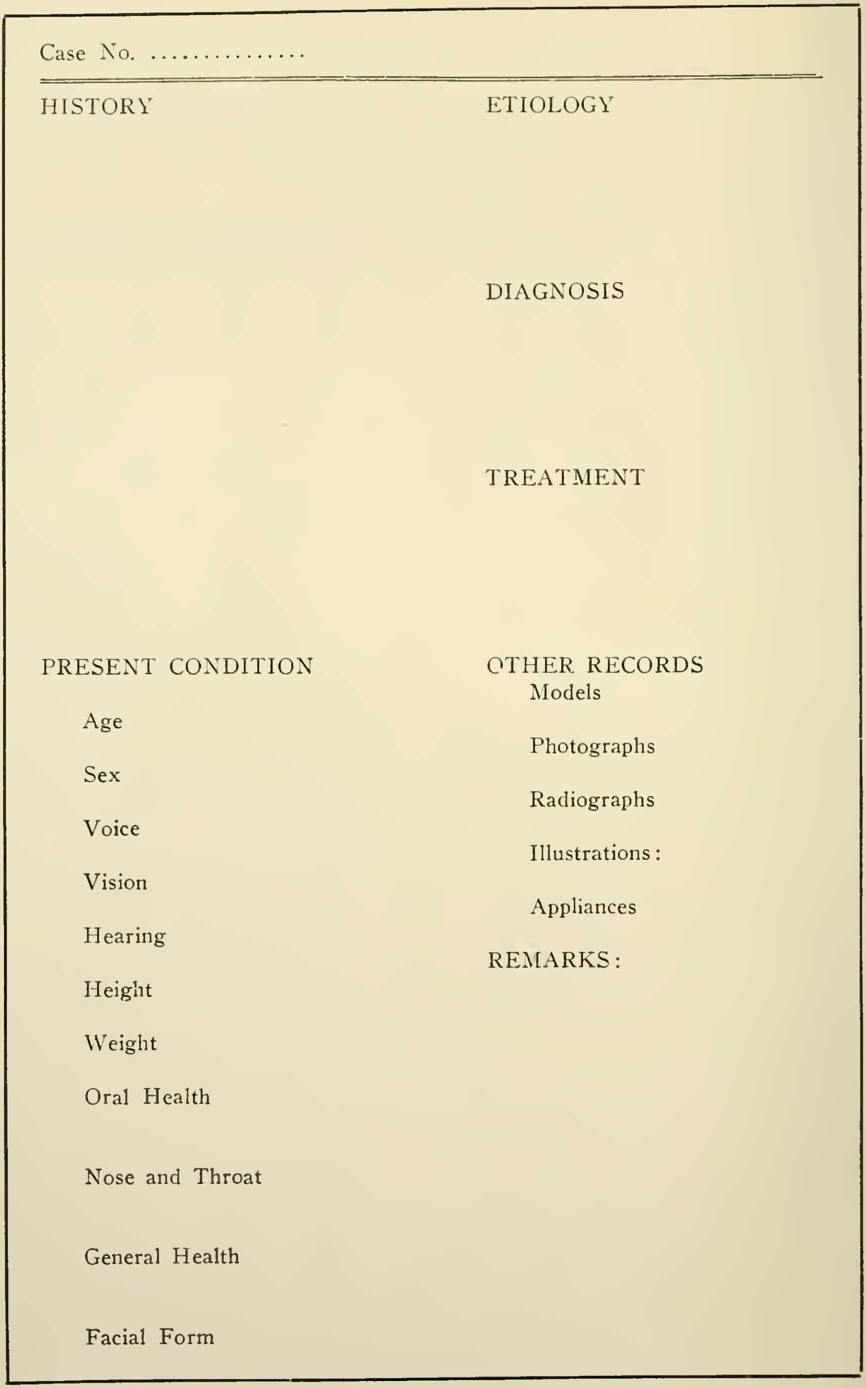
General Health

Facial Form

ETIOLOGY

DIAGNOSIS

Fig. 1.



Case No. ....

HISTORY

ETIOLOGY

DIAGNOSIS

TREATMENT

PRESENT CONDITION

Age

Sex

Voice

Vision

Hearing

Height

Weight

Oral Health

Nose and Throat

General Health

Facial Form

OTHER RECORDS

Models

Photographs

Radiographs

Illustrations:

Appliances

REMARKS:

Fig. 2.

Name
References
Parent
Vocation
Residence
Remarks:
Telephone

Date	SERVICES RENDERED	Dr.	Date	Cr.

Fig. 3.

IV. Plaster Models.

In 1756 Dr. Pfaff introduced the use of plaster of Paris for the construction of dental models. A review of the literature reveals the fact that it did not meet with universal favor, because eighty years later Kneisel still advocated sulphur for this purpose. Both employed wax as an impression material, and Kneisel frequently resorted to the use of metallic models in the construction of his appliances. These were made of fusible alloy and obtained from *plaster impressions* of his sulphur models.

The construction of accurate plaster models of the upper and lower teeth and adjacent parts is now considered a necessary detail of every orthodontic record, Fig. 4. Their value is greatly enhanced if they approach accuracy, and if they are filed with a comprehensive, written record.

During recent years a number of writers have provided quite elaborate descriptions of the methods employed in model construction. One enthusiast even strayed so far from the path of scientific accuracy as to pronounce a certain type of plaster plane which he employs as "the most important invention of modern orthodontia."

A common complication of malocclusion of the teeth is a marked distortion of the facial lines. Frequently, it is the only symptom which induces parents to seek a cure for their child's affliction. The value of an accurate record of such deformity has long been recognized, and the manner of its execution carried to a high degree of perfection by such masters as C. S. Case. Though the photographic method has steadily gained in popularity, the life size plaster model is still the most accurate method at our disposal. There are probably two reasons why facial models have not attained popular favor; first, many operators mistakenly consider their construction difficult; and second, owing to their size, their storage ultimately imposes a burden. But the filing of the dental models, though smaller in size, also becomes a problem in most offices, because of their greater number.

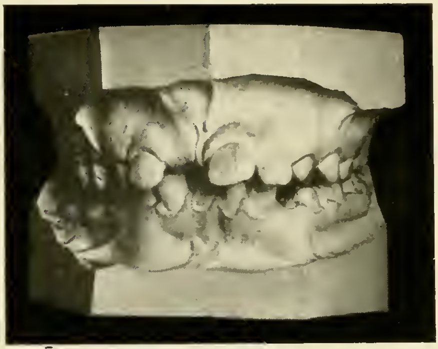


Fig. 4.

In the writer's practice the models of cases under active treatment are kept in wall cabinets adjacent to the operating chair. All other model are packed in pasteboard boxes 5 x 7 x 2½ inches, suitably numbered and stored on accessable shelves in a large closet constructed for this purpose. They are thus protected from dust and possible injury.

The occlusion and arch-relationship of all dental models should always be marked on the lingual side of posterior teeth. All facial models should also be indexed and the letter (F) prefixed to the numeral, thus F 1, F 1a, F 2, F 2a, etc.

In *Dental Cosmos* for 1915, Dr. J. A. W. Van Loon describes a very elaborate method of model construction of the teeth and face which is said to reproduce with greater accuracy "all deviations in all directions," particularly the relation of the teeth to the facial lines.

V. Photographs.

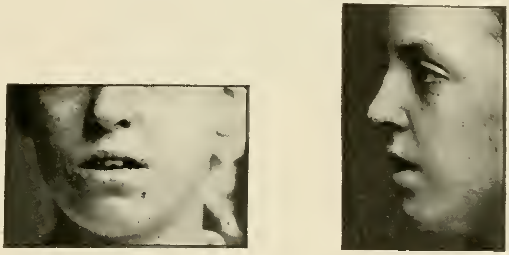


Fig. 5.

Portrait photography was introduced by Professor John W. Draper, of the University of New York, in 1839. Photographic records of facial deformities have met with quite general favor during recent years, and are now considered a necessary detail of complete treatment records, Fig. 5. Most practitioners have relegated the making of these photographs to the professional portrait photographer, but the results thus far attained have not reached that perfection which is desirable. The demands made upon the average photographer are such that he very early adopts a routine in posing his subject which will yield the greatest number of satisfied patrons. This uniformly means a picture which flatters the original. Patients with abnormalities of facial features are usually posed, and their negatives retouched in such a manner that the resultant photographs are anything but truthful. In the writer's experience the attempt to train a photographer to meet the requirements of a correct orthodontic record is a difficult, if not hopeless task.

Conversations with several members of this society regarding their experiences in this matter leads him to believe that disappointment is quite universal. In other words, good photographs of our patients can only be had (if we follow this method), by *posing the patient for the photographer.* It is obvious that such a procedure is quite impractical, if for no other reason than that it consumes too much time (unless the photographer lives next door).

The other objections to this method include the difficulties encountered in procuring the proper lighting effects and a uniform background; the same size of face ; the same style of pose; the rapid changes in style of print-papers and card-mounts, etc., all of which are discouraging and finally result in such a conglomerate mass of prints that many of us neglect, or entirely omit. this essential part of our records. In fact one of the ablest members of this society has told me that he "no longer bothers with it, unless some very unusual and extreme type of deformity presents itself for treatment."

In view of this faulty state of affairs I suggest that this society engage the services of a recognized expert photographer for our next annual meeting; that he be requested to present a paper on the subject, and give a demonstration of the best methods for making orthographic photographs, so that our members may acquire the necessary skill for making their own photographic records.

Investigations conducted by the writer have convinced him that stereoscopic pictures like Vol. III of Carl Witzel's "*Atlas der Zahnheilkunde*" would be a good method for recording facial deformities. These should be taken of *every case,* from the simplest type of malocclusion to the most extreme dento-facial deformity.

Now suppose one hundred men would file copies of all their cases in one central office, together with carefully prepared written records, including hair-color, eye-color, tooth-shade, etc., until one thousand, oi five thousand, such records had been compiled. Can anyone question the value of such a collection?

VI. Radiographs.

In the treatment of malocclusion of the teeth one frequently meets with anomalies of number, of eruption and of form. As is well known, the X-rays (discovered by Professor W. C. Roentgen, of Germany, in 1895) are of the greatest value for making a correct diagnosis in such cases, Fig. 6 (compare with Fig. 4).

It is not my intention to describe the process involved in making X-ray records, but to emphasize their value. By their use we can practically eliminate guess-work and definitely demonstrate such conditions as deficiency or redundancy of number, tardy eruption, anomalies of form and position, etc. One may also observe the progress of a treatment by making a series of films of the same case at frequent intervals.

The recent application of the stereoscopic method to this work is of inestimable value, because it makes for greater accuracy in the diagnosis of impacted teeth. Owing to the ever present opportunity for error, both in the making and interpretation of X-ray films, it would seem desirable for every orthodontist to acquire the technique necessary for producing them. A paper and demonstration on this subject at our next meeting would probably be of interest to many of our members.

It is hardly necessary to add that all films and prints should be numbered and filed, and the numbers should always be recorded on the record cards.

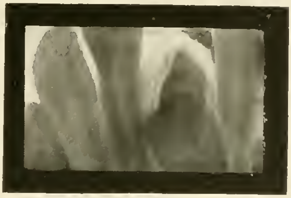


Fig. 6.

VII. Suggestions for a Comprehensive Index.

Now my review of these details of our records are perhaps unnecessary before this body (they are mainly inserted for the sake of completeness), but it gives me an opportunity to present a method for

NUMERICAL INDEX

No.	Name.	Consul.	Models.	Treatment.	Male.	Female.	Photo.	X-Ray.
470.	Vera D——	C.				F.		
471.	George E——	C.	326	T.	M		158	
472.	Eugenia B——	C.	328	T.		F.		
473.	Jack N——	C.			M.			
474.	George S——	C.			M.			
475.	Theodore F——	C.	329	T.	M.		159	
476.	Lucius C——	C.			M.			
477.	Harry C——	C.	332	T.	M.			
478.	Mary C——	C.	288			F.		12
479.	Charles R——	C.	195		M.			13
480.	Charlotte R——	C.				F.		
481.	Harry C——	C.	331	T.	M.		160	
482.	Julia S——	C.				F.		
483.	Amelia M——	C.	334	T.		F.		
484.	William H——	C.			M.			
485.	Edger H——	C.			M.			
486.	Mary C——	C.	333	T.		F.		
1911								
487.	Elizabeth W——	C.	353	T.		F.		

Fig. 7.

REFERENCE INDEX

Dr. W———— 3606 Grand Ave., Lindell 277 Dentist

1907

110. Edith W——
115. Carey L——
149. David G——
206. Paula F——

1908

231. Ethan S——
262. Russell M——
293. Franklin H——
321. Ester C——

1909

370. Ruth L——
451. Mamie N——
467. Evelyn G——
490. Alice S——

1910

550. Mary W——
571. Bernard W——

1911

605. Agnes F——
623. Marjorie H——
656. Frank S——
675. Lee W. I——
694. Robert S——

1912

700. Anne L——
747. Elsie——
765. Marjorie——
805. Fred——

1913

814. George——
839. William——
858. Lucy——
899. Elmer——
900. Henry——
922. Mary——

Fig. 8.

Age Index EIGHT YEARS OLD

35f—37m—56f—58f—92f—112f—132m—133f—145f—150f—157f—180m—183f—
198f—200m—201m—227m—239m—257f—271m—280m—282f—284f—297f—
298f—299f—310f—319m—322m—339f—340f—355f—359f—373m—374m—
385f—388f—393m—417m—426f—432f—434f—435f—438m—457f—461f—464f—
473f—476f—491f—492f—

Fig. 9.

compiling a card index of the various groups of facts which our practices severally provide. And my observations convince me that unless each one of us compiles such an index, a vast amount of valuable material is forever lost.

(a) Numerical Index.

On the front of the record a space is provided for the insertion of the *case number*. This number is recorded in regular order in the *numerical index*, Fig. 7. Following this number, the letter *C* may be

MODEL INDEX

325. Katherine G——
326. George E——
327. Leonora S——
328. Eugenia B——
329. Theodore F——
330. Dr. W——
331. Harry C——
332. Harry C——
333. Mary D. C——

1911

334. Amelia M——
335. Louis R——
336. Lucille C——
337. John B. K——
338. Paul W——
339. Helma K——
340. Ruth K——
341. Marie B——
342. Kathryn H——
343. Mary W. L——
344. Dorothy S——
345. Fred F——
346. Fannie F——
347. Irma I——
348. Mary B——
349. Louise N——
350. Jackson J——
351. Ernest H——
352. Wirt K——
353. Elizabeth W——
354. Gus N——
355. Dorothy S——
356. Pearl H——
357. Harry H——
358. Elizabeth C——
359. Clarace E. G——
360. Frances G——

Fig. 10.

Diagnostic Index DISTOCLUSION Five Hundred Models

BILATERAL

1—4—11—20—33—62—63—72—95—120
—130—136—139—148—150—154—161—
169—170—173—181—182 — 186 — 209—
225—227—230—232—252 — 253 — 261—
275—276—279—280—292 — 301 — 304—
306—321—323—329—332 — 347 — 350—
351—352—356—359—363 — 367 — 370—
382—399—402—406—409 — 411 — 431—
436—441—462—464—468 — 471 — 473—
476—478—487—488—495

UNILATERAL

5—15—29—75—83—96—105—125 — 160
—166—177—185—189—194—196—207—
233—236—270—277—305 — 307 — 328—
336—339—362—378—388 — 401 — 416—
421—424—428—432—447 — 449 — 465—
486—494—496

Fig. 11.

Diagnostic Index ABNORMAL FRENUM LABIUM Five Hundred Models

UPPER

1—42—66—76—77—91—100—107 — 118
—129—133—157—164—171—177—183—
192—194—219—283—299 — 311 — 319—
330—361—366—373—374 — 375 — 383—
385—388—405—406—407 — 415 — 437—
494—497

LOWER

42—

Fig. 12.

inserted to indicate a consultation; the model number to indicate if models were constructed; the letter *T* to indicate if treatment was administered; the letter *F* (female) and *M* (male) to indicate the sex of the patient. From this index one may then gather a number of interesting facts, e. g.,

Consultations	1000
Models	536
Treatments	467
Males	378
Females	622

(b) Reference Index.

In a private practice it is customary for prospective patients to mention the names of the persons who have referred them. For various reasons these names are usually entered on the examination blanks and later transfered to the record cards. If we now take a regular alphabetical guide and blank cards, such names may be further utilized as a *reference index,* Fig. 8. For convenience, they may be tabulated under three groups, viz., dentists, physicians and laymen. My index shows that my first 1000 consultations were referred as follows:

172	dentists	referred	602	cases
70	physicians	"	156	"
83	patients	"	242	"
		Total	1000	"

(c) Age Index.

Probably every orthodontist has followed the practice of recording the age of his patients on their record cards. By allowing a blank card for each age of which he has models, his secretary may compile an *age index* by transferring all the model numbers of a given age on the card for that age, Fig. 9. The value of such an index is very apparent, because it permits a comparative study of dentures. Five hundred models which I have thus had tabulated present the following ages:

Years	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	24	26	27	28
Cases	5	6	20	63	70	50	50	72	36	38	22	26	11	12	5	4	4	2	1	1	2

(d) Model Index.

Plaster models should always be numbered after completion and an index compiled for future reference. In the writer's practice this index, like all others, is kept on plain cards 5 x 7 inches. Fig. 10.

It starts with the numeral (1) and is arranged in regular order, allowing one number for each patient. All subsequent models of a given case are numbered with the same numeral and an alphabetical letter, e. g., 1, 1a, 1b, etc. These model numbers are also entered on the record card of the patient.

On the first day of January the year may be entered immediately below the last number in the index, which makes it possible to determine the number of new cases entered in any given year. The year is also entered on the numerical index previously referred to, which permits us to determine the total number of consultations and treatments for the year. In this way one can easily ascertain the comparative growth or decline of one's practice.

(e) Diagnostic Index.

You will recall that the record also provided a space for the diagnosis of a case. After models are constructed the model number is entered in the *diagnostic index*, where a card is provided for each type of oral deformity. Fig. 11. In this way all of the models presenting the same type of malocclusion are entered on the card for that type. Of five hundred models tabulated in this manner, my index shows the following:

Neutroclusion		*Bimaxillary Malformations*	
Simplex	163	Macrognathia	0
Complex	185	Micrognathia	3
Distoclusion		*Mandibular Malpositions*	
Bilateral	71	Retroversion	7
Unilateral	41	Anteversion	1
Mesioclusion		*Tumors of the Maxillae*	0
Bilateral	10		
Unilateral	10		
Maxillary Malformations		*Mandibular Anchylosis*	1
Macrognathia	0		
Micrognathia	4		
Cleft of the palate	1		
Mandibular Malformations		*Polygnathia*	0
Macrognathia	1	*Agnathia*	0
Micrognathia	1		
Curvature	1		500

Diagnostic Index ANOMALIES OF NUMBER Five Hundred Models

DEFICIENCY

1—64—87—109—120—127—133 — 140—164—171—181—226—287 — 335 — 336—347—368—382—390—451 — 453 — 479—494—497

REDUNDANCY

25—91—114—117—134—162—283 — 288—300—315—336—456

Fig. 13.

Etiologic Index NASAL OBSTRUCTION

6—7—9—11—14—18—30—31—32—33—35—40—45—52—54—55—65—79—84 — 98—101—105—106—120—122—128—131—139—142—143—146—147—148—150—151—152—154—160—161—165—166—167—169—170—173—177—186—187—190—194 — 200—201—203—204—207—212—213—215—216—217—219—225—227—228—231—235—237—239—240—241—242—248—249—253—255—256—257—262—263—264—267 — 272—273—274—275—276—277—278—279—280—281—285—286—289—291—292—294—295—301—304—306—307—318—319—320—322—323—328—331—332—338?—339?—343—345—350—351—352—353—356—357—359—360—364—370—371—377—380 — 381—386—387—389—391—392—393—395—396—398—399—406—419—424—426—428—430—433—438—441—443—444—445—447—449—451—452—456—458—461—462 — 463—464—467—471—473—476—477—478—481—485—487—492—495

Fig. 14.

Etiologic Index UNKNOWN FACTORS

3—4—5—8—10—12—15—17—21—22—24—26—27—28—29—37—38—39—43—44—46—47—48—49—50—51—53—57—58—59—61—62—63—64—67—68—69—70—71—72—74—75—78—80—81—83—85—86—87—90—92—93—94—95—96—97—99—100—102—103—115—116—119—121—123—124—125—126—130—132—136—137—138—141—144—145—149—153—155—156—158—159—163—168—172—176—178—179—180 — 181—182—184—188—189—191—193—196—197—198—205—206—208—209—210—211—214—218--220--221--222--223—226—229—230—232—233—236—238—243—245—247—250—251—252—254—258—259—268—269—270—290—293—296—302—303—305 — 309—310—317—321—324—325—327—329—333—341—343—344—348—349—354—355—362—363—367—368—369—372—376—378—379—384—385—397—400—401—402 — 404—408—409—410—411—412—413—414—416—417—420—421—423—425—427—429—431—432—434—435—436—439—440—442—446—448—450—454—455—457—460 — 465—466—468—469—470—474—482—483—484—486—488—489—491—496—497—498—499

Fig. 15.

The minor anomalies like redundancy and deficiency of number, abnormalties of the frenum of the lip etc., are similarly indexed on their respective cards, Figs. 12 and 13. Ultimately, when the number of cases recorded will reach 500, or 1000, for one given type, the value of the index will be considerable and will greatly reduce the labor otherwise involved if a study of a given type is undertaken.

I have also compiled an *etiological index,* which is beginning to be very instructive. I might state that it contains a card marked *Unknown Factors,* and that approximately 50% of my cases find their way on this card, Figs. 14 and 15.

But the possibilities of the card system are so numerous, it is so elastic in its application, that it deserves adoption by every practitioner who values his records at their true worth. One might go on giving illustrations of its use, but enough has been said to demonstrate its value. In conclusion, I desire to express the hope that my presentation of this subject will induce every one of you to begin the compilation of an index, and that in due course of time we may so agree on essentials that a measurable uniformity may obtain in our methods of keeping records, and thus, by common consent, make of this society a veritable library, or museum of facts, instead of a mere clearing house for pet theories which are too frequently based on insufficient data.

Discussion of Dr. Lischer's Paper

Dr. C. R. Jackson
Indianapolis, Ind.

When I first read the title of this paper I was not particularly interested, but after reading the paper and getting what I believe to be the essayist's idea, I was impressed with its importance.

The paper is timely and should be effective—awakening us to the importance of better and more complete records.

It is primarily an appeal for better records for the sake of their scientific value. Not so much individually as collectively. Dr. Lischer has given us an excellent record system but it would probably be as difficult to get one hundred men to adopt a certain record system, as to get them to use a particular method of keeping their accounts, and we all know that is impossible.

With an outline, however, of the desirable facts to be recorded and preserved, each man could use his own pet method of keeping them, from which he could compile the necessary data.

The essayist made a suggestion regarding a paper for the next meeting on the subject of portrait photography which I heartly endorse.

My experience with the professional photographers has also been such a failure that I am now trying to do it myself. Crude as they are, I am better satisfied with results.

This paper, if presented, should be accompanied by a practical demonstration.

Dr. Lischer's tabulation under numerical index carries me back to college days when one of the favorite questions was: "Is orthodontic treatment more imperative in one sex than the other?"

His record of sixty-two per cent. females shows that the laity do think its treatment is more necessary in the female or that it is more frequent in occurrence.

My practice, in five hundred cases presenting, shows 59% females.

I was particularly interested in the essayist's etiological index and the fact that about *fifty per cent.* of his cases were tabulated under unknown factors.

I would like to ask Dr. Lischer what per cent. of the fifty per cent. under known factors would fall under the heading nasal obstructions or mouth breathing?

Dr. Lischer. Responding Dr. Jackson: I could not answer at this time.

Dr. Jackson. Are we satisfied with our present knowledge of etiological factors? What advance can we make in the prevention of malocclusion with this imperfect knowledge?

Any of the tasks of records keeping suggested by the essayist are worth while if we can add to our positive knowledge in this point alone.

There is another point about which more light will be gratefully received and that is the necessary period of retention.

How many of us require our patients to wear retaining appliances too long?

I shall not speak for those in the society whose years of experience have given them the advantage, but among the younger men in the specialty I believe it is universal.

During the first few years the new orthodontist cannot afford to do much experimenting. Later in his practice it is not so serious.

I wish to enter a plea for the younger men. Is it not possible by uniting all our experiences to arrive at something more definite regarding the necessary period of retention?

If the essayist is right, and I believe he is, that from a mass of facts collected from thousands of cases logical deductions can be made of great value, then are we truly losing time by delay in collecting these facts.

Might it not be advisable for the society to furnish each member with a printed index card having the proper headings to be filled out from data obtainable from a year's practice?

These individual record cards could then be turned over to a committee for tabulation and classification.

The essayist says this data must be accurate, concise and practical.

Where, however, can you find a body of men better trained by their work in these qualities?

Dr. C. B. Wheeler New York. A copy of Dr. Lischer's splendid paper was received nearly a week ago and although I have had time to read it over carefully and give some thought to the subject, other matters have interfered, so that I could not get together some forms and have them in the shape I wished, for this meeting. I think the society fortunate in having this subject so ably brought to our attention, because to my mind it is of the highest importance that we collect all facts possible, in regard to the practice of orthodontics, and that they be recorded in such manner that they can be readily gotten at, both for our own use, and that of others.

When the Doctor states that "it therefore seems eminently worth while to discuss the methods generally employed in keeping office records," I heartily agree with him because if there is any plan or short cut by which we can obtain the results we are after, and thus interfere less with our general work we should all know it. Perhaps the majority of you may carry through nearly the same plan in keeping records, but if only a few are greatly benefitted, and others get just one idea that will make it easier for them to record the facts, which I am sure we all want, it may be only a few years before we all will receive something from what has been obtained to-day.

I will give you just a general idea of the way a new patient is taken care of, in regard to records, etc., in my practice.

Consultation Cards. At the first sitting, impressions are taken at the chair, the occlusion carefully noted, case classified and anything out of the ordinary talked over with the parents or others who may be with the patient. They then step into the next room where I turn them over to my secretary, after giving her the classification and anything out of the ordinary, which I have been able to learn from my talk. On consultation cards made for the purpose, she records the full name, address, references, habits, previous operations, if any, condition of the patient, and anything else of interest that I have been able to bring out. The secretary getting the data saves considerable time.

No further thought is given to this case until the models with consultation card is brought before me. After giving them the study necessary, the probable cause of the condition is marked down, prognosis and any remarks in regard to treatment, appliances, etc.

With the card and models before me a letter is dictated to the patient, guardian or parents of the patient, stating what I hope to accomplish, approximately the time it will take, intervals between visits, fee, and any other information they may desire.

The models are then marked lightly with name of patient and date, placed in a box with name on the outside and stored in a model closet used for this purpose. Then the boxes are so placed that the names are in alphabetical order.

Patient's Book.

The data from the consultation card is then copied in a loose leaf book which we have named "The Patient's Book," together with all facts from the letter written, the dates, etc. Any further correspondence before the work, should it be undertaken, is also noted. This book to me has been most valuable. Should a patient call up in six months or a year after the consultation and wish to go ahead with the work or ask some question, the secretary has the whole history of the case before me in a moment's notice.

Numbers.

Should the decision be made to have the work undertaken, the patient is given a number, the models taken from the closet and put in the model cabinet for use. This number is then placed on all models, pictures, radiographs, records, etc.

Photographs.

At the first sitting, besides taking impressions for working models, wedging, or fitting bands, pictures are taken. I came to the conclusion a number of years ago that it is impossible to get a photographer always to pose a patient, so that the condition which I wanted recorded would show to the best advantage. For this reason I installed a camera and portable background, in the office, studied my lighting, and arranged so that the outfit be kept in a closet ready to use at a moment's notice. In this way I have been enabled to get four negatives of a patient, and the whole outfit replaced in the closet again within fifteen minutes. Pictures from these negatives are placed in envelopes, the envelope marked with the patient's number and then filed in numerical order.

Radiographs.

Radiographs are treated in the same manner but kept in a separate file.

Appointment Book.

After this sitting, it is my practice and at all subsequent ones to step into the secretary's room with the patient, and give the secretary an outline of what has been done and what we will probably try to accomplish at the next sitting. This is taken down in shorthand on a small pad. I then leave the secretary to make the appointment, and return to my chair where the next patient has been installed by my assistant during the interval. I have never been able to obtain an appointment book that just suited me so that I get a large book, eight inches by ten inches, with plain ruling, and have the days, dates and hours written in. One page is given up to a day and divided into hours and quarter hours. When the appointment is made, there is placed after it a note, stating what will probably be done at the next sitting.

Record Cards. On the record cards is placed the number, names, reference, age, estimated time of treatment, diagnosis, prognosis, etc. Columns are left for the date and the time given at each sitting. After the patient has been discharged, the secretary enters on this card from her stenographic notes just what has been done, any loss or breakage of appliances, failure of any result that we are striving for, or broken appointments.

Ledger. My ledger simply has to do with the financial part of the case.

Index. The idea Dr. Lischer has given us in regard to an index, is in the main what caused me to have kept on the record cards the time given to cases, form of appliances, failures, etc., together with other data.

The one that I have been evolving for the last two years is not at the present time satisfactory, owing to the fact that there is a mass of material tabulated, which to my mind is not necessary. This I believe will be rectified within the next year.

I feel sure that if Dr. Lischer's paper only stimulates us to greater activity along these lines it will lead to something worth while.

Dr. Delabarre. I want first to express my appreciation of Dr. Lischer's paper and his method of keeping records. It is what I am looking for at the Forsyth as I have been unable to develop any satisfactory system as yet of keeping records, and I appreciate the value of scientific data in helping us to solve our peculiar problems. We would be lax at the Forsyth without some such system as Dr. Lischer has presented to-day. It is our purpose to install some such system.

Photographic System at Forsyth Infirmary. I feel in regard to photography that I have something I may present to you along that line that is at least an addition to anything that has been spoken of to-day. We have a system of photography, incomplete in many details, and yet it is a system. I cannot go into it deeply enough to take your time to tell all about it. I will simply say this much in regard to the results we get: we get pictures uniformly one-quarter life size. Patients are always posed in a uniform manner vertically and with the "Plane of Frankfort" spoken of by Van Loon always in a horizontal plane. There is superimposed over the negative in printing, a screen of vertical and horizontal lines so disposed and for the purpose of studying the symmetrical or the asymmetrical development of the individual in a lateral and in the anteroposterior direction. Our purpose, as Dr. Lischer's purpose, is to aid us in the scientific study of what constitutes normal facial development. Every patient is photographed according to our system and the photographs filed away.

We try to get together all the children of a tender age—four, five, six and seven that present what seem to be apparently normal development up to that time. These we place in what we call a normal development observation class, with the purpose of collecting all the data we can with regard to that patient, height, weight, and all the things that may influence his bodily development, with the hope that in the period of fifteen or twenty years we may be able to get case histories of five hundred or five thousand individual children, studied from the standpoint of normal development. The question of photography is included for the scientific data we are trying to get. It will be possible to classify your cases by taking pictures in this manner, according to maldevelopment, age or any peculiarity to compare them, make composites from the negatives so we may be able to develop a composite type of normal occlusion—a composite type for Class I, II or III or any of the subdivisions of malocclusion.

Dr. Manly Bowles. I was greatly interested in Dr. Lischer's address. For some time past I have felt the need of a better record than the one I was keeping, and was trying to work out a scheme of my own, when I got the program. Dr. Lischer has helped me.

Occasionally I have been accused of causing decay by my orthodontic treatment. I admit that I have seen decay occur during or shortly after treatment, but I am not prepared to admit that such decay was caused by the treatment. I believe that in nearly every case it would have occurred anyway. I send patients to have every cavity filled before treatment is commenced but there are cavities with very doubtful margins; likewise on some teeth are "spots" indicating that in all probability cavities will sooner or later appear whether orthodontic work is undertaken or not. Lately I have been marking such teeth on a chart, showing it to the patient or parents and explaining to them what is likely to happen in any case. I believe that this will save me a lot of "explaining" in future years.

Dr. Cryer. I would like to suggest an idea as to getting a definite size of all pictures of patients you may have to make. Focus a rack and pinion camera for a full size, half-size or whatever you may require and mark the different points on your camera rack, then when you have decided on the size desired fix your camera at that point and adjust at the proper distance from the patient or specimen until the figure shows sharp on the ground glass. The camera should be arranged on a stand so it can be moved backward or forward. The best lens for this purpose is one that has not a deep focus when a large stop is used.

Dr. Bart. I would like to ask Dr. Delabarre what percentage of children applying to the Forsyth Infirmary are in need of orthodontic attention? Also if these children are required to pay for the appliance, etc.

Dr. Delabarre. We went over our records for the first year and found 95.4% of the children examined had malocclusion and needed orthodontic interference. In regard to the payment, the Forsyth is a charitable institution, aiming to reach only the very poor and to render a service which is practically charitable. The patients who come there are accepted only after passing an examination with the social service worker to make sure the services are given to the deserving poor. The patients who come, no matter what the work is that may be done, pay five cents a visit.

Dr. Cameron. I enjoyed Dr. Lischer's paper. He spoke several times of the making of radiographs. We may get to making stereoscopic radiographs sooner or later, but we must take definitely the point or tooth we wish to get, and to get at that we must have the film in the mouth in a definite position and know the angle of the rays as they are directed to the film. In making our radiographs we use a small plate of aluminum. The film is slipped into that, placed in the mouth and the patient bites on it while in place. (Instrument exhibited.)

Dr. White. I hope there will be some concerted action in regard to the society working together in the matter of records. Dr. Lischer has gone to a lot of trouble. I have talked with the efficiency men of the Ford Motor Co., of Detroit and they have records to show. Out of 33,000 men they know how many Germans, French and English there are, and could tell what each family spends to live, how much wages are paid and how much each man saved. Those records were complicated; the money and time expended was great; but the knowledge they will gain from them will be immense. I thought of how efficient commercial firms are becoming. and I wondered if professional men were keeping pace with them.

Dr. Weinberger. I want to say a few words in appreciation of Dr. Lischer's paper. His suggestion of a paper on photography for next year was a very good one. Every man specializing in orthodontia should have some knowledge of this branch. Every model that we have in our office should be photographed and filed away as a matter of record. Recently upon walking into an office I found one of our members on the floor picking up the remains of what was left of his models. His cabinet becoming top heavy fell and every model on the floor was broken. Had these been photographed he would have had some record left. This only shows one important use of the camera. A word or two in regard to records, namely card index. On account of the bulk they consume, weight, chances of being misplaced, I do not consider the use of same as satisfactory as the loose-leaf system.

Dr. Lischer. I would like to ask Dr. Delabarre if I understood him correctly, viz., do you photograph every patient at the Forsyth clinic, regardless of whether he receives orthodontic treatment or not?

Dr. Delabarre Only the orthodontia patients.

Dr. Lischer. I think it would be a very valuable piece of research to *photograph every individual,* which is an undertaking for which institutions are peculiarly fitted. The doctor has told us of the percentage of malocclusion, and his figures are very much higher than I had supposed. A few writers have estimated the percentage of facial deformity due to malocclusion. but no one has presented reliable statistics. One of you has just whispered across the room that every case of malocclusion presents facial deformity to some extent. But such a statement is of no value whatever, unless you present the facts upon which it is based.

And then think of the varying degrees of deformity, even in the same type of malocclusion; and of the variations in hair color, eye color, complexion, tooth shade, etc. But underneath all these facts, if they are accurately recorded and carefully classified, the student would soon perceive a connection and relationship which might lead to the formulation of laws of the greatest practical value in practice.

I have long felt that our happy-go-lucky attitude in this matter (to regard facial deformities and their correction as a sort of artistic by-product or side-show performance of orthodontic art), is entirely too superficial. If we are as scientific as we pretend, or as we ought to be, then nothing but a thorough study of the pathology of dento-facial deformities, which would include every detail, would satisfy us. And how can we know their pathology if we do not first master the normal? And how master the normal if we do not study the normal in a thorough and comprehensive fashion?

Dr. Jackson was good enough to refer to a matter which I purposely omitted, that of statistics on post-treatment maintenance. I think we are all agreed that we know very little about it. As I tell my students: the only rule we have been able to formulate is, that it is better to maintain teeth in their new relations longer than necessary, rather than not long enough; and that any time estimate not based upon statistics is a poor guess at best.

But as I said in the beginning: I present this subject for your consideration with the hope that I might acquire some information and not impart it; and if any one of you has a better method of keeping records I would be glad to hear from you. The cards from which my slides were made will be shown at the clinic to-morrow.

Control of The Overbite in Treatment of Class II Cases.

By Dr. Herbert A. Pullen, Buffalo, N. Y.

The abnormal relations of the dental arches in malocclusion, in which there exists the condition known as the "abnormal overbite," is one that will bear considerable study beyond our present conceptions of its etiology, diagnosis and treatment before the causation of all of its peculiarities in development is perfectly understood and its baffling difficulties in treatment mastered.

And too often have cases of malocclusion been treated in which the abnormal overbite has been overlooked, or regarded as an irremediable typal defect, with the result that the most important factor of the malocclusion has remained untreated, a condition being left which invariably inhibits the results of other treatment through its abnormal influence upon the occlusal planes of the dental arches, and upon the inclined planes of the individual teeth.

In fact, it has only been within the last few years that a determined effort has been made among orthodontists to analyze the variations from the normal in the development of the occlusal plane, and to correct these conditions by the application of scientific principles of treatment, whereby the occlusal planes are corrected in their maldevelopment and the normal overbite restored.

Just at this point it is essential that we distinguish between what is known as the overlap and the overbite of the teeth. They may be defined as follows:

Overlap.

The overlap, strictly speaking, is the distance the upper incisors and cuspids cover the lower incisors and cuspids when in contact. This may be normal or abnormal.

Normal Overbite.

The normal overbite is the normal overlap of the upper incisors over the lower, as governed by the proportionate length of cusps in bicuspids and molars and by the normal development of the occlusal plane.

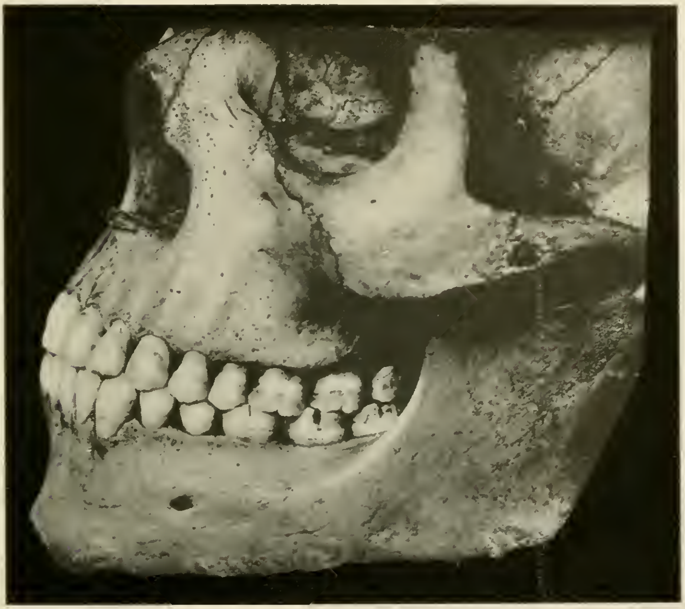


Fig. 1.

Let us examine for a moment the normal denture and observe a normal overbite, its relation to the occlusion of the rest of the teeth, and to the occlusal plane, and, by comparison, determine to some definite degree what the normal overbite is; in other words, make a differential diagnosis between the normal and abnormal overbite.

In Fig. 1, a skull exhibiting normal occlusion, the normal overbite is represented by the normal overlapping of the upper incisors over the lower incisors to a degree commensurate with the depth of the cusps of the bicuspids and molars, and in proportion to the level of the normal occlusal plane and to its curve.

The normal relations of the incisal edges of the lower incisors to the upper incisors in occlusion is in contact with the lingual inclined planes of the upper incisors below the lingual ridges. This is recognized as the normal overbite and overlap.

The degree of contact of the labial surfaces of the lower incisors with the lingual surfaces of the upper incisors will vary according to the normal angles of labial inclination of the upper and lower incisors, varying somewhat with type and temperament.

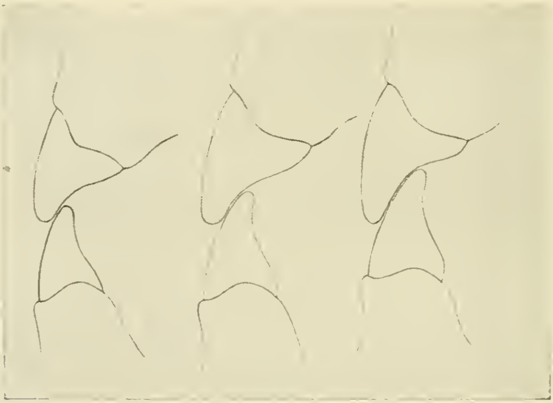


Fig. 2.

The average depth of the normal overlap is about one-third the length of the crowns of the incisors, varying also according to type and temperament, being greater in the bilious and nervous temperaments, and less in the sanguineous and lymphatic types.

Black says: "The incisors and cuspids occlude so that the cutting edges of the lower incisors and cusps of the cuspids make contact with the lingual surfaces of the similar teeth of the upper jaw near their cutting edges. In this, however, there is much variety within the limits of a normal occlusion. Sometimes the lower incisors strike the lingual surfaces of the upper near the linguo-gingival ridge and may strike at any point between that and the cutting edges." *The linguo-gingival ridge of the upper incisors is thus seen to be the point below which the normal overlap and overbite are confined.*

These variations in the normal overlap and overbite are diagrammatically shown in Fig. 2.

The depth of the normal overbite, in which the lower incisors occlude below the linguo-gingival ridge of the upper incisors, bears a certain relationship to the depth of the cusps of the bicuspids and molars, in that a deep overbite accompanies deep cusps in the bicuspids and molars, and a short overbite is associated with correspondingly short cusps in the bicuspids and molars, as illustrated in Fig. 3.

The depth of the overbite also bears a peculiar relation to the curve of Spee, or the normal horizontal curved occlusal plane. In Fig. 4 is illustrated in diagram the relation of the curve of Spee, which is an imaginary line beginning at the incisal edges of the lower incisors and touching the tips of the cusps of the cuspids, and the crests of the buccal cusps of the bicuspids and molars, extending, if projected distally, along the anterior face of the articular surface of the condyle. According to Turner, this curve more frequently passes posterior to the anterior face of the condyle than anterior to it.

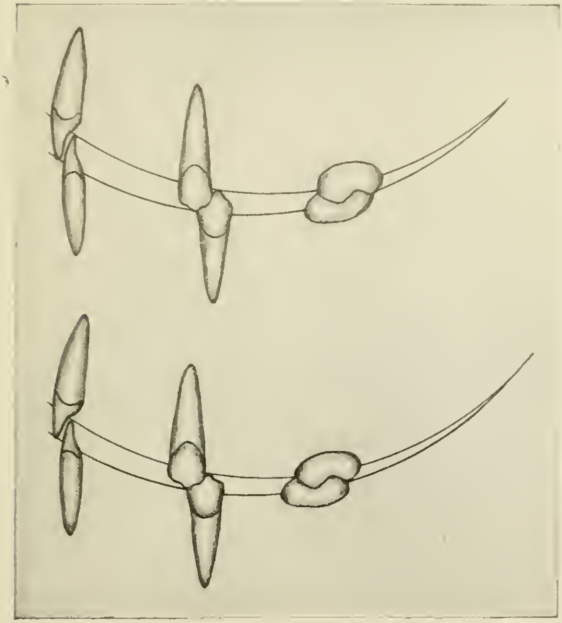


Fig. 3.

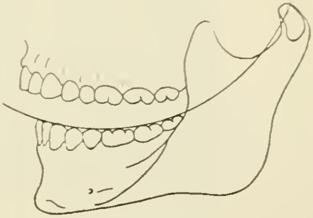


Fig. 4.

When the overbite is normally shallow, as in the cast on the right of Fig. 5, the curve of Spee is long and less perceptible; when the overbite is extensive and the overlap abnormally deep this curve is shorter, its concavity is exaggerated deeply, the incisal edges appearing much higher than the cusps of the bicuspids, as in the cast on the left in Fig. 5.

Fig. 6 exhibits a short cusped overbite with a long curve of Spee.

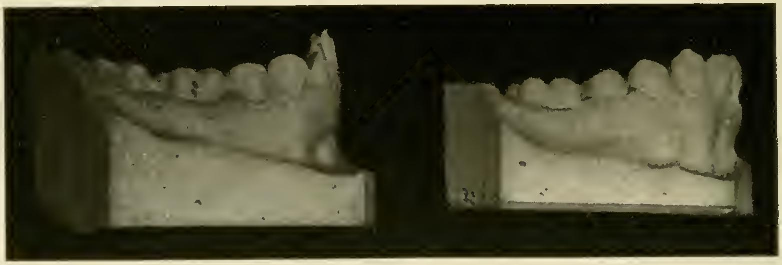
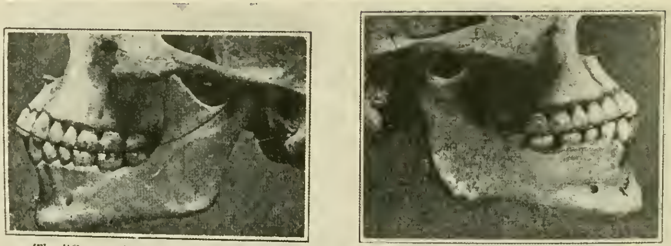


Fig. 5.



The "Curve of Spee." Short cusps and long curve. Line passing through anterior face of condyle. (Specimen No. 4237, Wistar Institute of Anatomy.)

The "Curve of Spee." Short cusps and long curve. Line passing distal to anterior face of condyle. (From photograph of specimen No. 800, Wistar Institute of Anatomy.)

Fig. 6.

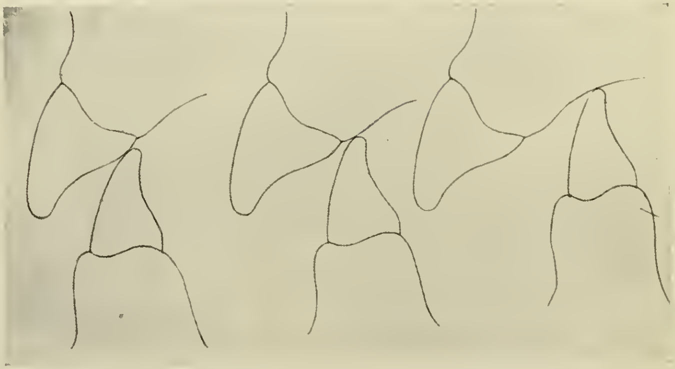


Fig. 7.

Variations of Abnormal Overbite.

The abnormal overbite may vary in extent from a slight infringement of the edges of the lower incisors upon the lingual ridges of the upper incisors to an extreme malocclusion in which the edges of the lower incisors occlude with the gums three-quarters of an inch or more lingual to the upper incisors. Fig. 7 exhibits three positions of abnormal overbite, between which many intermediate degrees might be represented.

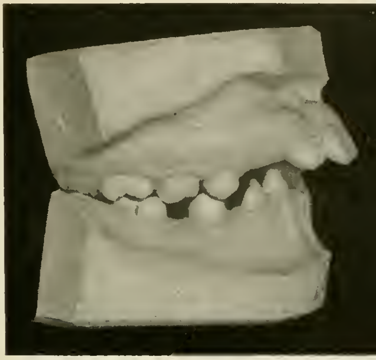


Fig. 8.

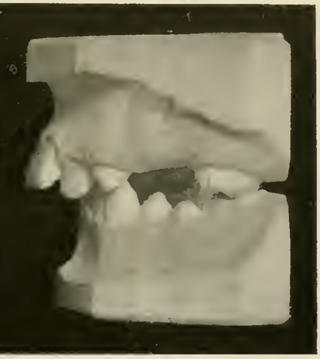


Fig. 9.

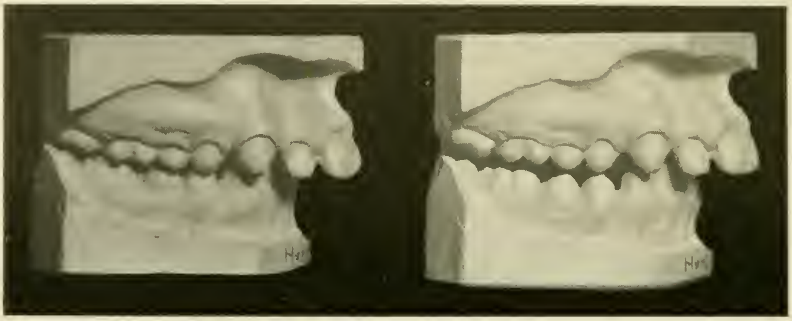
The abnormal overbite may thus be considered as beginning where the normal overbite ends, viz., at the lingual ridge of the upper incisors. That is, the differentiation of abnormality is the occlusion of the lower incisors on the inclines of the lingual ridges of the upper incisors, or on the gums lingual to them.

These variations in the abnormal overbite do not always indicate a distal occlusion, as they occur in Class I, especially in the so-called "upper protrusions," as well as in the divisions of Class II, and determine in a measure the extent of arrested or deficient development in the vertical growth of the dental arches in these cases, and in their correction the degree of perfection of results in occlusion and harmony of facial lines.

Abnormal Overbite and Facial Inharmony.

Any marked change from the normal in occlusion is easily noticed in the facial lines, and the deep overbite, especially in the "upper protrusions" of Class I and the first division of Class II, exhibits a very noticeable facial inharmony. The degree of facial inharmony in these cases is also measured by the depth of the overbite and the distance between the lingual cutting edges of the upper incisors and the labial cutting edges of the lower incisors.

Fig 8 exhibits an abnormally deep overbite of Class I, and Fig. 9 an abnormally deep overbite of Class II, and it will be observed that except for the mesio-distal variation from the normal in occlusion of the bicuspids and molars the anterior malocclusion is identically the same. Likewise, it would be difficult to determine from a study of the profiles alone in which one the distal occlusion exists.



a Fig. 10. b

Structural Changes in Development.

A further analysis of these cases reveals certain structural defects in the development of the dental arches which accounts for the production of the deep overbite, and which gives a clue to the only practical method of treatment.

If the casts of a case exhibiting the deep overbite, as in a, Fig. 10, be separated in parallel planes and the incisal portions placed in the positions of a normal overbite, b, it will be noted that the bicuspids and molars are separated to a marked extent, and that this position marks in a general way the normal plane of occlusion, and also that the width of this space between the dental arches measures the lack of development in the dental arches. This would indicate that there is in these cases a *lack of downward vertical development* in the upper dental arch and of *upward vertical development* in the lower dental arch.

Dr. A. P. Rogers, in a paper before the American Society of Orthodontists, describes the incipiency of this condition as follows: "During that period of transition between the loss of the deciduous and the complete eruption of the permanent teeth, there is a gradual growth of the face in length, breadth and depth. The length is influenced very largely by the increased vertical development of the teeth and their processes. It is during this period, in normal cases, that a new and correct occlusal plane is developed; but in those cases where abnormal influences are introduced there is a destruction of occlusal balance frequently resulting in maldevelopment of the occlusal plane."

These inequalities in growth in the dental arches are not caused by the abnormal occlusal relations, but instead, the abnormal occlusal relations are determined by the degree of arrested or deficient development in the vertical growth of the dental arches. The inhibition in nutrition and lack of stimulus to normal vertical growth in the dental arches thus interferes with the development of the *normal occlusal plane.*

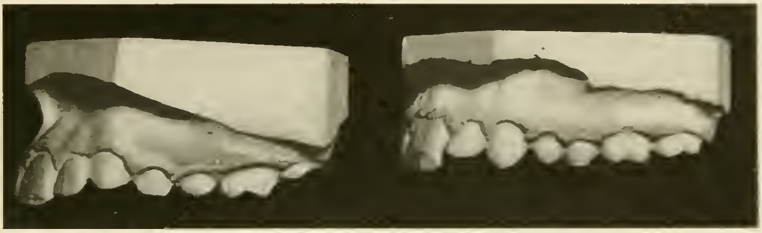


Fig. 11.

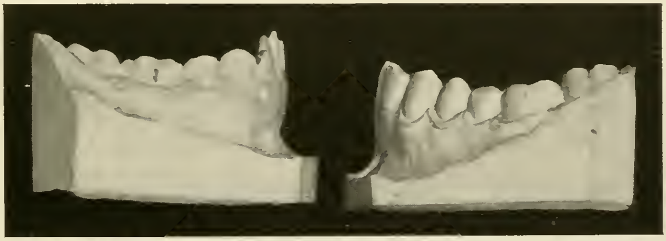


Fig. 12.

Inhibitory Influences in Development of the Occlusal Plane.

Just what these inhibitory influences are in the development of the occlusal plane is difficult to determine accurately, as a number of factors may combine in the maldevelopment.

A deficiency in the use of the muscles of mastication and deglutition, as well as a lack of respiratory function, as noted by Dr. F. B. Noyes, may each have a share in this inhibitory influence in development of the bony structures of the dental arches.

Again, the causative factor may be a lack of the stimulating action on development produced by the pituitary and other glands of internal secretion.

These conditions of maldevelopment found in connection with the deep overbite may or may not be associated with mouth-breathing and an unhealthy tonsilar ring. Adenoids and mouth-breathing may be as much a symptom of derangement of functions as is the arrested or deficient development of the dental arches.

There is lacking, at any rate, that stimulus to normal development of the dental arches which, if not provided by the orthodontist, will otherwise never be initiated, so that when the permanent teeth are all erupted, the occlusion is entirely out of balance, and the forces of malocclusion establish and confirm the abnormal overbite and other symptoms of the maldevelopment.

In many cases of this kind the normal plane of occlusion of the upper arch is just reversed, as in Fig. 11, with an apparent elongation of the upper incisors. It is not improbable in some cases of this nature that there is a slight overdevelopment in the vertical plane in the incisor region.

In other cases, the curve of the occlusal plane of the lower arch is deeply exaggerated, as in Fig. 12, the lower incisors seeming elongated and the bicuspids depressed.

Structurally, then, there is apparent in connection with the deep overbite the lack of vertical development, or infra-occlusion in the regions of the bicuspids and molars in one or both of the dental arches, a possible overdevelopment in the incisal region in some cases, and at the same time a marked deviation of the plane of occlusion from the normal.

The dental arches may also be lacking in growth, in length and breadth, while exhibiting all the symptoms of maldevelopment in connection with the deep overbite.

Some orthodontists believe that there is no supra-occlusion of the incisors in these cases of excessive overbite, but that in Class II, Div. II cases, for example, the "incisors which were apparently in supra-occlusion had in reality only reached their proper positions, and, by reason of the infra-occlusion of the molars, usually the lower, the incisors were allowed to glide past each other."

Dr. R. W. Strang,* in an article on the etiology of Class II. Div. II, notes the "omnipresent overbite," and suggests the possibility of the excessive overbite causing the distal occlusion. He remarks as follows: "With this normal overlapping in the incisor and cuspid region in the deciduous arches, we find six inclines pre-eminently and unnaturally active. They are formed by the lingual surfaces of the upper incisors and cuspids and the labial surfaces of the lower incisors and cuspids. In this abnormal position they at once become the longest, the most powerful, and, therefore, the most positive of all the inclines in action at this age."

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* R. W. Strang, American Orthodontist.

"One of three conditions must arise or a combination of two or all of them: (1) Either the upper incisors must be carried labially; (2) the lower incisors must be carried lingually: (3) or the mandible must be forced distally."

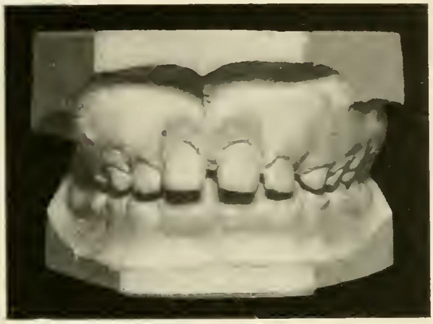

Fig. 13.

The first of these conditions, or the labial movement of the upper incisors with separation in the deep overbites of Class I, has been frequently noted by the writer. Fig. 13 illustrates such a case in Class I, the lower incisors occluding well above the lingual ridges of the upper incisors which are protruded and separated.

The second possibility, or the lingual movement of the lower incisors, due to the force of the inclined planes in the deep overbite, occurs less frequently, but may occasionally be noted.

The third result or the distal displacement of the mandible by the deep overbite in cases of Class II, Div. II, the writer has not as yet been able to verify in his own practice, but it is not improbable, although the distal position of the lower arch may in some cases occur even before the eruption of the deciduous incisors, when the abnormal overbite would be a secondary effect, conformative to the distal relation.

In some cases, more frequently in Class II, the abnormally deep overbite has caused the lower incisors to bite deeply into the gums lingual to the upper incisors so that inflammation and soreness of the gums develop. In one of the writer's cases, the pain from this cause was enough to cause nausea after each meal, which immediately subsided after "opening the bite" sufficiently to relieve the lower incisors from contact with the gums.

Also, in cases of abnormal overbite, the temporo-mandibular articulation shares in the structural and functional derangement to the same degree to which the dental arches are arrested in their vertical development, and only after correction of the malocclusion does the full function of articulation come into play.

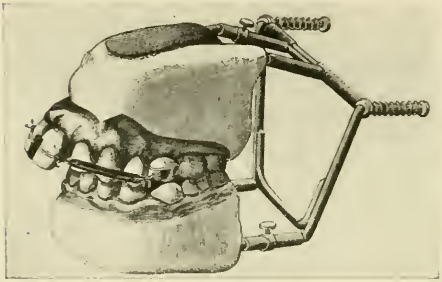

Fig. 14.

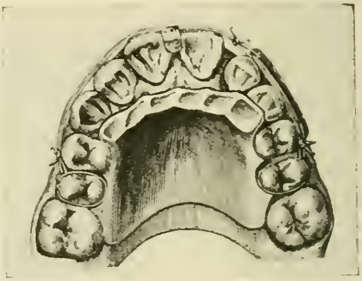

Fig. 15.

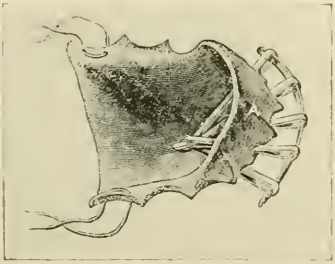

Fig. 16.

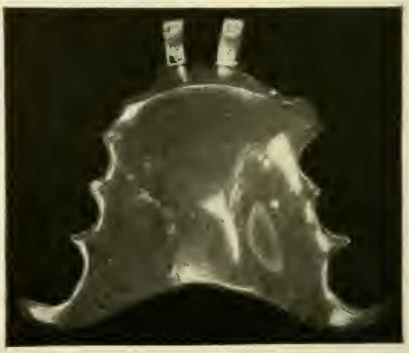

Fig. 17.

Early Methods of Treatment of the Abnormally Deep Overbite.

The first efforts at correction of a malocclusion exhibiting these defects were directed at the treatment of its most prominent characteristic or symptom, so to speak, viz., at a depression of the lower incisors in their sockets and a retrusion of the upper incisors at a time when the classification of malocclusions was unknown. Frequently it was advised to extract one or more bicuspids from the upper arch and retract the incisors and cuspids.

One of the earliest efforts at correction of a case presenting with the deep "overbite" is described by Bonwill in *"Harris's Principles and*

Practice." Apparently a case of Class II, Div. I, it presented unusual difficulties, as may be seen from Fig. 14, the casts being placed in Bonwill's articulator for study of the positions of the teeth and relations of the dental arches in articulation. The history of the case showed that the arches of the temporary teeth were normal and the cause of the condition was obscure.

The lower incisors were three-eighth of an inch distant from the upper incisors, and were biting into the gums lingually to the upper incisors. In attempting the correction of this case, illustrated in Fig. 15, Bonwill made use of a roofplate "thickened where the lower teeth would touch" sufficiently to "open the bite" about one-eighth of an inch, as he described it. "This was not only to drive the inferior incisors up farther into their sockets, but to allow the bicuspids and molars to come down and antagonize before the plate was removed."

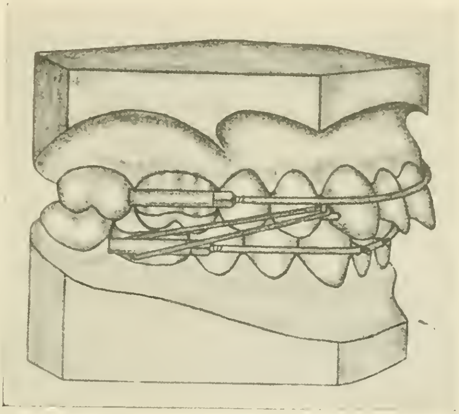

Fig. 18.

"Two years were consumed in this. To this plate I now attached a rubber band around the arch with a silk ligature, and at the central incisors I made a metal hook, carried over their cutting edges with two holes through which the ligature passed. This kept the ligature down on the incisors near the cutting edges, and while it was aiding in drawing in the arch, it did another very important thing, forced the centrals up into the alveolus."

The result of treatment of this case was not published, but no doubt the relations of occlusion, especially of the overbite, were improved, and by the partial use of a principle which is not far different from part of the apparatus in use at the present day.

Kingsley describes the use of a roofplate with inclined plane, as shown in Fig. 16, for "jumping the bite," which at the same time acted to depress the lower incisors, and by "opening the bite" give the bicuspids and molars an opportunity to develop occlusally.

Passing over the intermediate history of attempts to correct the deep overbite, which were practically the same until the Angle classification of malocclusion came into use, we can take it up at a time when the etiology and structural development of these cases came to be more specifically studied, and more scientific and definite results in treatment obtained.

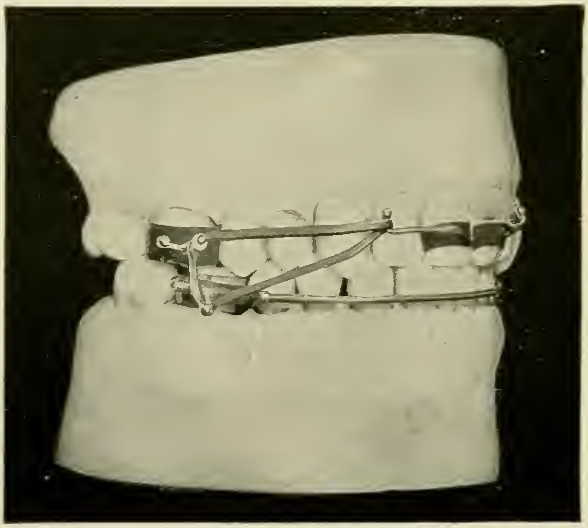

Fig. 19.

Angle described in his textbook (7th ed.) the use of the vulcanite roofplate, with hooks to engage the incisors, Fig. 17, for the purpose of opening the bite before shifting the occlusion in the treatment of the first division of Class II. He remarks concerning this roofplate: "If constantly worn from two to six months, the molars will have become lengthened and the proper length of bite established."

In the treatment of Class II, during the shifting of the occlusion with intermaxillary force, as in Fig. 18, the deep overbite sometimes disappears through the opportunity given for the molars and bicuspids to develop in the vertical plane. More frequently, however, this vertical development in the bicuspid and molar region does not occur at the same time, and it becomes necessary to stimulate this development by appliances especially constructed for this purpose.

The later methods of correcting the abnormal overbite do not depend so much upon the principle of the inclined plane in forcing the incisors into their sockets and allowing the molars to lengthen, as upon a more scientific combination of appliances adjusted to stimulate the development of those areas of the dental arches, which through their lack of vertical development, cause the abnormally deep overbite, viz., in the regions of the bicuspids and molars.

Dr. A. P. Rogers suggested a method of combining the inclined plane with the use of intermaxillary force, Fig. 19, applied for shifting the occlusion and extruding the molars in the treatment of the first division of Class II, which operates very successfully in some cases. Dr. J. Lowe Young described a looped wire inclined plane, Fig. 20, for use in a similar manner as the inclined plane of Dr. Rogers. The method is ideal in so far as it tends to develop the undeveloped areas of the upper and lower dental arches in the vertical plane. The fixation of the upper incisors for any length of time through the attachment of the soldered inclined plane to incisor bands is not desirable, and a method of overcoming this defect in construction has been suggested by Dr. C. A. Hawley. It consists in the use of individual inclined planes on each of the incisors, thus giving them perfect freedom in movement. These individual inclined planes, Fig. 21, are made of wire loops bent to form inclined planes and adjusted to the occlusion of the antagonizing incisors in the lower arch.

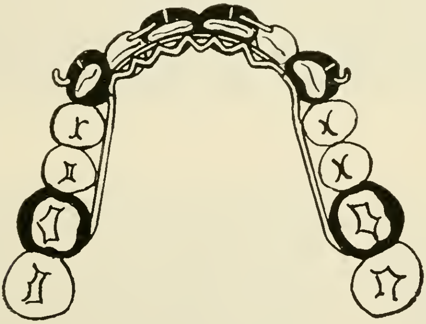

Fig. 20.

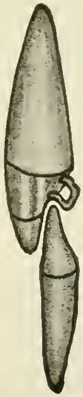

Fig. 21.

A method has been suggested for use in cases of "mixed dentures" in which the roots of the deciduous molars are not absorbed, and that is to crown the deciduous molars and open the bite until the overbite is normal, and at the same time to apply intermaxillary force to shift the occlusion from distal to normal and elevate the first permanent molars.

Fig. 22 illustrates a Class II, Div. II case of the writer's partially treated in this manner. The model on the right exhibits the bite opened by the crowns on the deciduous molars. The triangular use of the intermaxillary elastics in this case is shown in the drawing, Fig. 23. This method has some objectionable features, in that it can be used in but few cases on account of the early absorption of the roots and the loss of the deciduous molars. Again, the pressure of the intermaxillary force tends to force the deciduous molars into their sockets rather than to develop the region of the bicuspids in the vertical plane.

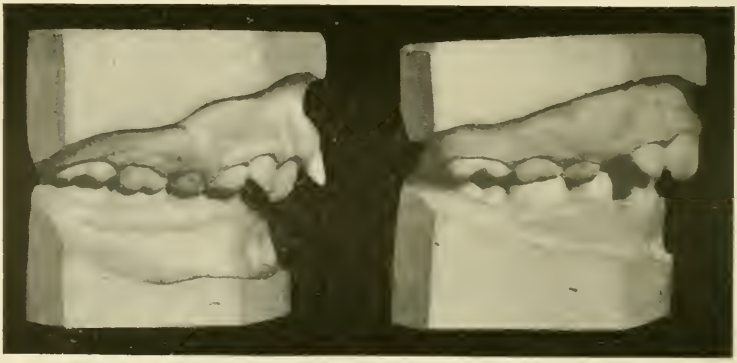

Fig. 22.

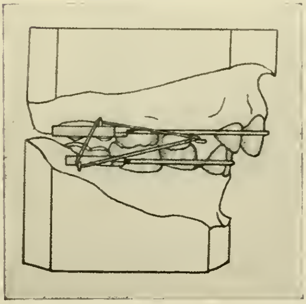

Fig. 23.

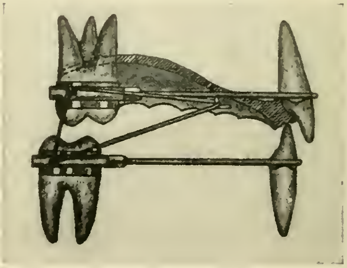

Fig. 24.

A method which is considerably used by orthodontists for changing the overbite consists in the use of the roofplate with a thickened portion anteriorly in the form of an inclined plane for the lower incisors to be held apart from occlusion with the upper while the expansion arches are adjusted for shifting of the occlusion and extruding the molars at the same time. This combination is diagrammatically shown in Fig. 24

The operation of the intermaxillary elastics is to produce a force which tends to develop the dental arches vertically while the occlusion is being shifted mesio-distally. The application of the law of the parallelogram of forces, Fig. 25, exhibits the resultant of the force, KD and ED, to be the force CD, which exerts an upward and forward pressure on the lower arch and a downward and backward pressure on the upper arch.

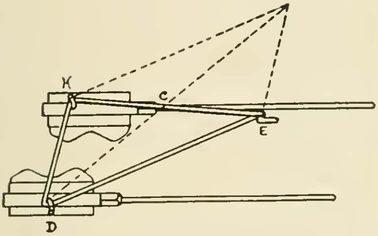

Fig. 25.

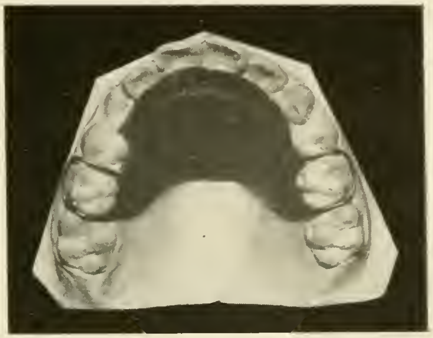

Fig. 26

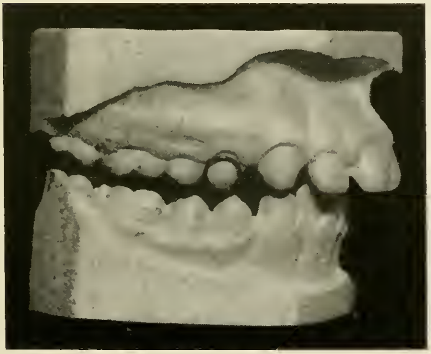

Fig. 27.

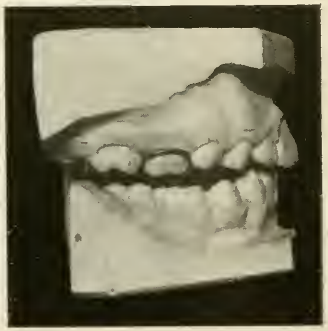

Fig. 28.

One difficulty in the use of the roofplate has been its ease of removal from the mouth, this being fully as undesirable as the fixation of the incisors with the gold inclined plane, and the writer has adopted the additional use of the Jackson cribs to assist in holding the roofplate in place, as in Fig. 26. By means of these cribs the plate may be made much shorter and it will interfere less with the speech

The cribs are first made upon the bicuspid teeth in the permanent arch, as in Fig. 27, or upon the deciduous molars, if in the deciduous arch, Fig. 28, and their ends imbedded in the wax baseplate, the inclined plane of which is adjusted to the lower incisors with the casts in the position of correct occlusion, and from this wax pattern the vulcanite plate is made. The expansion arches are then adjusted upon the teeth as in the treatment of the first division of Class II, shown in Fig. 18.

The expansion arch is used in the beginning on both upper and lower dental arches until their correct shape has been obtained, after which a removable lingual arch may be substituted for the lower expansion arch, the roof plate with inclined plane inserted, and the intermaxillary elastics adjusted, first from the hooks on the upper expansion arch to the hooks on the lower molar bands and later in the triangular position, as shown by the dotted lines in Fig. 29.

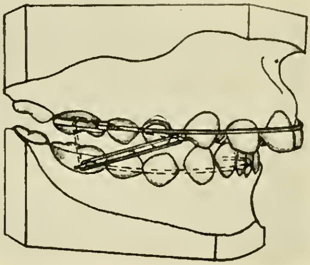

Fig. 29.

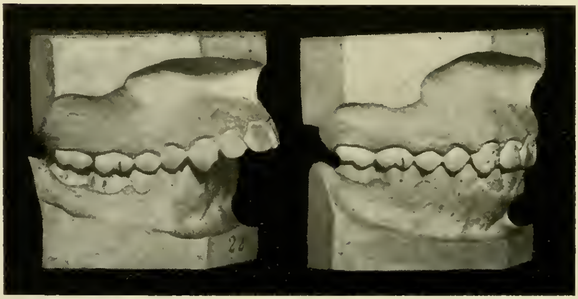

Fig. 30.

The neatest construction of the removable inclined plane is that suggested by Dr. J. Lowe Young in the cast inclined plane, which is attached to a lingual arch provided at its extremities with half oval rods fitting into half oval tubes on the lingual surface of molar bands.

These methods of treatment which have just been described are more adaptable for treatment of the mixed dentures in which the bicuspids have not erupted, for after the eruption of these teeth it is evident that the extruding of the molars will have very little influence on the vertical development of the occlusal plane in the bicuspid region.

In the permanent denture the curve of the occlusal plane can be plainly seen and its degree of abnormality easily observed by studying the movements of the mandible in articulation. The correction of the occlusal plane may be confined to either one or the other of the two dental arches, according as to which arch exhibits the predominating abnormal curve.

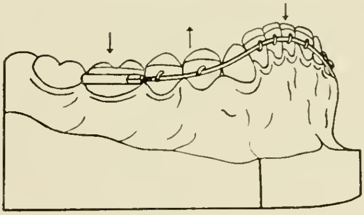

Fig. 31.

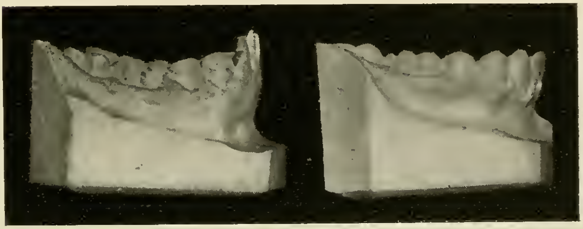

Fig. 32.

For example, in Fig. 30, a case of Class II, Div. I, with an abnormally deep overbite, the lower dental arch is decidedly the one exhibiting the greatest degree of abnormality in the occlusal plane, the incisors being much higher than the bicuspids and the application of another method of treatment than heretofore described is necessary.

The use of the expansion arch as a double elastic lever, in a somewhat similar manner to that first described by Dr. C. S. Case, is especially applicable in these cases. The expansion arch was adjusted for this case, as in Fig. 31, under hooks on bicuspids bands and over hooks on incisor bands for changing the abnormal occlusal plane. Fig. 32 represents the change in the occlusal plane of the lower arch after this treatment.

The rest of the treatment does not differ from the usual treatment of Class II, Div. I, in which the occlusal plane of the lower arch is not changed. The combination of appliances for shifting the occlusion and changing the occlusal plane of the lower arch at the same time is shown in Fig. 33.

Fig. 30 illustrates the before and after treatment models of the case, and the restoration of normal occlusal relations.

In some cases in which the occlusal plane of the lower arch is abnormal, it may be corrected by elevating or extruding the bicuspids with the elastic spring lever, Fig. 34, as described by Dr. J. Lowe Young. The lever is attached at the distal end of the buccal tube and engages anteriorly with buccal hooks on the bicuspid bands, being sprung downward into position.

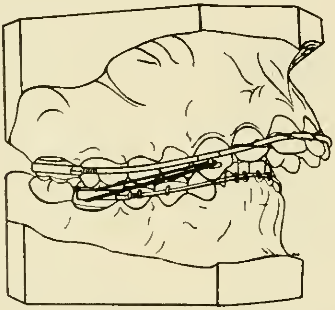

Fig. 33.

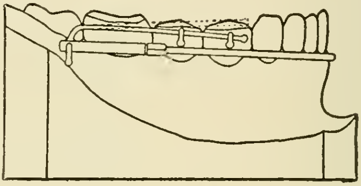

Fig. 34.

In many cases the abnormal curve in the occlusal plane is found in the upper arch, as in Fig. 35, a Class I case with an abnormally deep overbite. By comparing the casts of the upper arches before and after treatment in Fig. 36, the change in the curve of the occlusal plane will be seen to be exactly reversed.

The upper incisors were in supra-occlusion and were intruded in their sockets while the bicuspids were extruded. This change may be made in precisely the same manner as described for the change in the occlusal plane of the lower arch.

One objection to the use of the threaded expansion arch in cases of this kind is the difficulty of inserting it in or removing it from the horizontal buccal tubes. This may be overcome by the use of a horizontal buccal tube which has an attachment allowing its removal in the vertical plane, as in Fig. 37, in which is shown a horizontal buccal tube with an oval rod attached, engaging a vertically placed oval tube, locked by a spring catch extending from the horizontal buccal tube to the end of the vertical oval tube.

A simpler method is to use a .030-inch threadless arch, Fig. 38, with the vertical oval rod and tube anchorage, and a loop placed anterior to the anchor tube for lengthening the arch wire when necessary. The change in the curve of the occlusal plane by this method is diagrammatically shown in the lower drawing in Fig. 38.

Summary.

In connection with the treatment of the abnormally deep overbite in either Class I or II, the dental arches should be first developed laterally and anteriorly, so as to restore their normal sizes and forms, and secondly, appliances should be adjusted for the correction of the abnormal overbite. Especially in the second division of Class II it is quite frequently observed that the distal occlusion requires but little treatment after the dental arches have been expanded, the release from the condition of contracted dental arches often allowing the distal occlusion to change to normal without the use of intermaxillary force, and after the occlusal plane of the dental arches has been restored the overbite becomes normal.

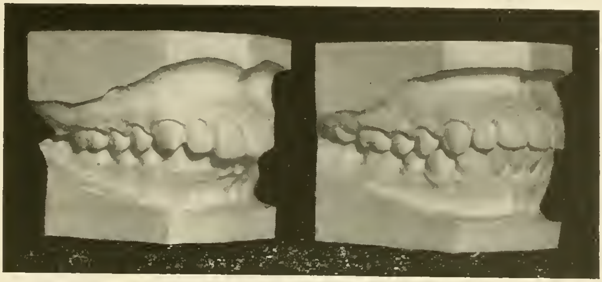

Fig. 35.

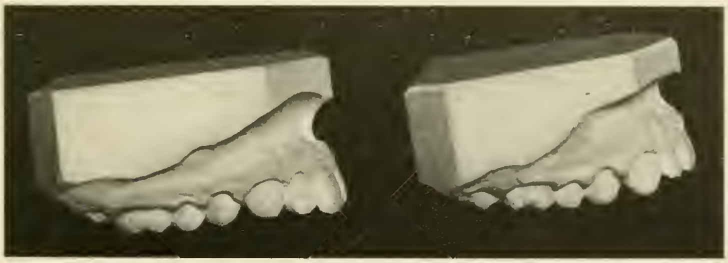

Fig. 36.

An analysis of the structural maldevelopment in connection with the deep overbite reveals two chief factors, the lack of vertical development in the bicuspid and molar region and the inhibition in development of the normal occlusal plane. The temporo-mandibular articulation also shares in this deficiency in structural relation.

The facial inharmony has been shown to be proportionate to the degree of depth of the abnormal overbite, and symptomatic of this condition to a large extent.

It is suggested that in view of the similarity in maldevelopment, malocclusion, and facial inharmony in many of the "upper protrusions" of Class I with the deep overbite, and the cases of Class II, Div. I, with the deep underbite, that the distal occlusion is more of an incidental characteristic in the Class II cases, rather than a vitally important factor in the differential diagnosis. The distal occlusion, however, establishes the only indication for a mesio-distal change in the occlusal relations in Class II cases beyond the similar treatment for the deep overbite in Class I and Class II by stimulating vertical development in the bicuspid and molar region and establishment of the normal occlusal plane and normal overbite.

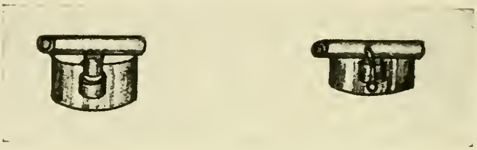

Fig. 37.

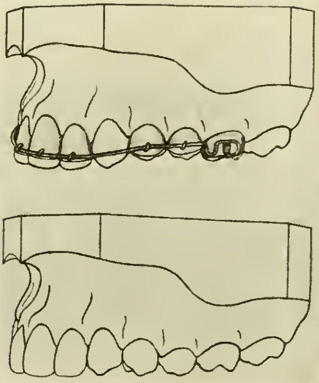

Fig. 38.

The inhibitory influences in development causing the abnormally deep overbite and abnormal occlusal plane are thought to be largely nutritional, possibly lack of pituitary function, and also lack of proper stimulating force in development due to insufficient masticatory function and deglution, as well as deficient respiratory function.

The history of the treatment of cases exhibiting the deep overbite shows a progressively scientific treatment based upon the known etiology as well as upon the theoretical causative factors.

The mechanical stimulation of undeveloped areas in connection with the correction of the abnormally deep overbite must be supplemented by the establishment of normal masticatory function, normal deglution, the initiation of normal respiratory function, and, if possible, by the correction of defective metabolism and nutrition, and deficient functioning of the glands of internal secretion which control bodily growth.

The investigation of the causative factors in connection with the abnormally deep overbite, as well as in many of the pronounced malocclusions of the dental arches, shows the necessity for a broader understanding of the factors influential in bodily growth as a whole, and the extent of the overlap of orthodontia into the field of medical research, to investigators to whom we must look to supply the missing links in developmental possibilities beyond which we are unable to progress without further specific knowledge.

Discussion of Paper by Dr. H. A. Pullen.

Dr. Rogers Boston.

As is usual in discussing a paper by Dr. Pullen, one finds the subject is presented in such a definite way that there remains little for the discussor to criticize and little for him to add. Perhaps, however, a few suggestions from my own experience in the treatment of these cases may be of value.

We must ever bear in mind that the cases of abnormal overbite may prove the most difficult to treat barring perhaps those which exhibit an open bite. Cases of malocclusion in which the overbite seems to be abnormal are persistent in their efforts to return to their original condition. Therefore, the retention must be prolonged. The parent and guardian should be thoroughly instructed, first, as to the nature of these cases, and be given to understand the probable length of treatment. It has been evident many times in my practice that the proper readjustment of the arches with relation to their shape and size often takes care of the trouble. It has, therefore, become with me a first principle to develop both the upper and lower arches to their full size and attempt to adjust the occlusal relations by means of the intermaxillary elastics before a final decision to make an application of the inclined plane.

Periods for Beginning Treatment.

There are various periods during which the treatment of these cases may be undertaken. Some periods seem to be much more propitious than others. I have been less successful in the treatment of cases of abnormal overbite in the full deciduous dentures, frequently finding with the eruption of the permanent teeth a recurrence of the condition similar to that which existed in the deciduous dentures. My treatment of these deciduous dentures has been that which has been employed by many of you—that of the control caps upon the deciduous molars which are allowed to remain until the full eruption of the four permanent molars. Even after these molars have been in place some time, I have been surprised and disappointed to find a recurrence of the overbite after the loss of the deciduous molars.

A more favorable period for treatment is that during which the occlusal plane is beginning to develop. The proper relation to the arches should be established at this time. If the free development of the bicuspids and molars is permitted, the result is often most gratifying. Everything must be done at this time to prevent interference with the natural development of the molars and bicuspids. It is, therefore, quite frequently desirable to free the teeth from interference and to depend upon the inclined plane which is often anchored to the four anterior teeth, never losing sight of the fact that too much strain on the incisors is undesirable, and that they may be depressed; and that after establishing what appears to be a normal occlusion you may be surprised to notice an overbite again appearing following the removal of the inclined plane.

I have been frequently reminded from cases in my practice that the most desirable period for a correct and permanent result is during the development of the permanent cuspid teeth. I have found to my satisfaction sometimes, during the progress of treatment, when able to get control of the upper and lower cuspids and bring them into proper relation, that my troubles ceased. This appears to be equally true in Class I and Class II cases. The lower arch must be developed sufficiently in the cuspid region.

Just recently I have had a most satisfactory case of this kind. The patient was unusually hard to handle, and after making use of the lingual wire on the lower and establishing proper relation between the cuspids, a simple cuspid to cuspid retainer, was all that was necessary to retain the result.

With relation to the maintainance of the balance during the use of the intermaxillary elastics I would suggest that we be most careful not to use them too strong, and to make sure that the direction is correct and study to maintain balance.

I hope there are some men here who can give us encouragement in the treatment of this class of case before the loss of the deciduous dentures. It would be ideal if we could fully and permanently correct them at that time.

Dr. Lourie
Chicago.

Dr. Pullen will excuse me if I omit the compliments and proceed to follow out the intention of his paper, which, he says, was to start a discussion if possible. Some of the points to which I shall refer are probably the result of a little hurry on Dr. Pullen's part in preparing the paper, but should be corrected, to avoid misunderstanding.

What is the normal overlap of the incisors? Dr. Pullen says that the abnormal overbite begins where the normal ends, at the lingual ridge of the incisors, and it might be inferred that anything below the lingual ridge of the upper incisors is a normal overlap. That is speaking generally, and I should like to have it understood (as I think it is correct) that for some cases the overlap may be below the lingual ridge, and still be abnormal for those particular cases. Certainly any overlap beyond the lingual ridge is abnormal.

Another point: he states that the normal overlap is proportionate to the length of the cusps of the molars and bicuspids, and I do not agree with that; at least not in the cases that have come under my observation. It may be true, in the average normal denture, that the overlap is proportionate to the length of the molar cusps, but it is not always so in the abnormal cases which come to us. Possibly that is one reason why the overlap is abnormal, because the relation between the incisor length and the molar cusp length is not proportionate. He says, the overlap is approximately one-third the length of the incisor crown, and that the overlap therefore, is proportionate to the length of the incisor crown. Well, I know there is a greater variation in the length of incisors (at least it seems so to me) than in the molar cusp length.

Etiology of Excessive Overlap.

Provided the overlap is excessive, where is the maldevelopment which is responsible for the excessive overlap? According to the essayist, in the case, in which he has advanced the lower arch in vertical plane so that the tips of the lower incisors occlude (with proper overlap) with the uppers, the distance between the upper and lower bicuspids shows the amount of underdevelopment vertically in the bicuspid region. This, I think, is not a clear statement of the conditions, although Doctors Watson and Ottolengui will probably support the essayist in contending that it is all a lack of development in the bicuspid region and not overdevelopment in the incisor region. The above statement would indicate that the deviation from normal is entirely the result of lack of development, whereas in one or two other places in the paper he speaks of depressing or intruding the incisors. If it is entirely a lack of vertical development in the bicuspid region, the incisors should not be intruded. I feel quite certain that in many of the cases, or in some, the incisors have been overerupted—either the upper or the lower, and sometimes both—and consequently, as a preliminary to our treatment, we should decide as nearly as possible just what is the cause, or maldevelopment feature of the case: whether it is a lack of vertical development in the bicuspid region or an excessive development in the incisor region, or a combination of both; because the treatment should be suited to the conditions to be corrected.

Dental Occlusion.

I should take exception to the statement that distal occlusion is merely incidental in these cases, believing that, given a distal occlusion to start with, this excessive overbite may develop as a result of the distal occlusion. Possibly I misunderstand the intention of the essayist, and what he meant to say was that there is a great similarity between Class II, Division I cases and many Class I cases. I believe the distal occlusion of the lower arch throws all the occlusion upon the molars and bicuspids, and, consequently, from excessive use they do not erupt to full height; and the incisors and cuspids, from lack of normal occlusal contact, erupt vertically beyond their normal positions.

Advantageous Influence of Erupting Teeth.

As this is so largely a matter of under or over-development, it seems to me the time for treatment is an important item to be considered, as Dr. Rogers has pointed out. I have noticed too, with Dr. Rogers, that these cases of excessive overbite respond to treatment better about the time of the eruption of the permanent cuspids. The influence of the second permanent molars I believe is an aid, and that it is the developing action of these teeth that has favored us in opening the bite by extruding the first permanent molars.

I do know this: that I have, in a number of cases, opened the bite where I did not intend to open it, at the time of the eruption of the second permanent molars, and I think it was caused by a loosening action of my appliance on the first molars while the erupting forces of the second permanent molars were directed upon them, and that really the first permanent molars had been erupted beyond normal by the growing forces of the second permanent molars. I have felt so sure of this that, in cases in which there is approximately a normal incisor overlap, I avoid the use of the intermaxillary force while the second molars are erupting. On the other hand, it seems to me advisable to time our treatment so that we may get the benefit of that erupting second molar action in cases with abnormally excessive incisor overlap. I believe it is this influence, or the influence of other erupting teeth, which accounts for the fact that sometimes the mere correction of the arch alignment of the two dental arches, corrects the overbite, and also the mesio-distal relation of the arches. Even though care is taken in the use of our expanding appliances, there is apt to be some disturbance of the anchor teeth, and while they are loosened up there is more or less extrusion of them, which accounts for the correction of the incisor overlap. It is my opinion that in cases of normal overlap, Class II, Division I, the use of the inter-maxillary force should be deferred until it is certain that it is necessary, for the reasons just explained; and in the subdivision case, shown by the essayist, (Subdivision of Class II, Division II) I would suggest that if the mesio-distal shifting of the molars and bicuspids can be accomplished without the inter-maxillary elastics, it is the advisable thing to do, to avoid the danger of opening the bite by the inter-maxillary force. If the incisors are to be intruded it should be done before the use of the inter-maxillary elastics for shifting the mesio-distal relation of the arches, for the purpose of conserving the stability of the molar anchorage. If the incisors are to be intruded, pressure should be applied upon them one or two at a time and not upon the whole four at once, in order to keep a preponderance of stability in the anchorage. Of course, if intruding the incisors is not necessary, the other plan of treatment would be advisable—the exerting of pressure on all of the incisors and possibly the cuspids, with the purpose of straining the molar anchorage and extruding those teeth.

Tube and Pin Appliance.

Reference was made to the beneficial effects of the "New Angle Appliance," and I should like to ask Dr. Pullen, simply for the sake of accuracy, to describe that appliance a little more carefully than by calling it the "New Angle Appliance." As I understand, there is another new Angle appliance, and we should not know to which one he is referring. I suggest it be call "The Angle Pin and Tube Appliance." He mentioned that that appliance seemed to have a beneficial effect in stimulating general development. I think the explanation of that is not so much that it causes stimulation of the general development. as. that the reverse reciprocal action of the spring used in getting a labial movement of the upper incisors, exerts an extruding movement on the molars; and, while you may have put that appliance on with the intention of correcting the incisors first, or truing up the arches, the reaction has brought about a vertical development of the molar region, and really the bite has been opened and has caused a correction of the abnormal overlap.

Use of Inclined Plane.

I have not found it necessary to use the inclined plane for excessive incisor overlap, and should advise against using it on a lingual arch fastened to the molars; for the reason that further eruption of the molars is necessary, as well as the bicuspids, and if the inclined plane is attached to it there is occlusal contact on the inclined plane, which force is transmitted, more or less, to the molars. I have used the inclined plane, attached to the lingual arch, in assisting to maintain the mesio-distal change of the dental arches; but think if it is for overcoming the abnormal overlap, it should be attached to the anterior teeth, as mentioned by Dr. Rogers.

The essayist thinks it an advantage to have the lower lingual arch attached so as to give great freedom to the molars, while I feel that it is a benefit to have the attachment more rigid, to prevent tipping in either the mesial or lingual direction as a result of the pull of the inter-maxillary elastics. Also, with the lingual arch more rigidly attached, it can be used more safely with the downward pressure against the lingual inclines of the lower incisors to assist in truing up the occlusal plane of the lower dental arch.

There is a statement in the paper which I should like to have explained. I do not quite get the differentiation between the abnormal curve of the occlusal plane and the abnormal overbite. It seems to me that those expressions are interchangeable.

I object to the number of bands required in the "reciprocating spring appliance" shown for truing up the occlusal plane. There are four bicuspid bands and four incisor bands, eight bands, with sixteen thicknesses of metal inter-proximally (I do not count the molar bands, as the lower ones compensate for the upper). I am getting at the inharmony between the sizes of the upper and lower dental arches caused by using sixteen thicknesses of metal, to say nothing of the cement, between the teeth inter-proximally. They necessarily make the upper dental arch quite a bit larger than the lower, and increase the overlap. If the overlap be adjusted with the bands on, it will be greater than without them. I know it to be a fact, as I have worked against it, trying to retain teeth with all of these anterior bands in place, and could not get them into normal contact and overlap until I had removed the bands.

Dr. Hawley
Washington.

I think our ideas of the treatment of Class II cases are progressing. My conception of conditions existing in these cases is different now from what it was six of seven years ago. Formerly we had a good deal of discussion about the intermaxillary elastics, and what they do—whether they move the teeth along the body of the jaw: whether they tip the teeth, or whether they make a change in the temporo-maxillary articulation or bend the neck of the condyle. As I have gone along in treatment, there are so many cases that correct themselves in the mesio-distal relation that I have come to the belief that in the majority of cases the change that is produced by the intermaxillary elastics is produced in the temporo-maxillary articulation.

Etiology of Distal Occlusion.

My conception of distal occlusion is this: that there are some influences that change the upper arch that do not change the lower in the same degree. In all the cases of distal occlusion make this comparison: take first a case of normal occlusion and make a drawing of the line of occlusion, which passes through the crests of the buccal cusps of the molars and bicuspids, and through the incisal edges of the incisors; take the arch described by that occlusal line and place inside of it the occlusal line of the lower teeth (which also passes through the crests of the buccal cusps and the edges of the incisors) in its approximal position, so that the teeth would be in normal relation and you will find a constant relation in the distance between those two lines. If 3 m.m. in the molar region, it runs nearly constant about the arch. If you study the same lines in a case of distal occlusion and place the lower occlusal line inside the upper in the relation which they occupy in distal occlusion, you will find that to get the proper distance between the lines in the molar region, the lower occlusal line must be drawn backwards. If placed in proper relation in the incisor region, it will be too close together or almost in contact in the molar region.

Now it has seemed to me that there are these influences that work on the upper jaw and they do not work in the same degree on the lower. The upper arch is contracted. The lower jaw, in order to find a comfortable occlusion in the molar region, travels backwards; probably very slowly; but it travels backwards. It has been my practice in later years, at the outset, to harmonize the arches. Many times the lower arch is not normal: it is contracted, but not to the same degree as the upper one; possibly you may have to enlarge the lower arch slightly, but the upper much more, to place them in their harmonious relations for normal occlusion. If you do that, in a great many cases you do not require intermaxillary elastics at all. The lower jaw, in order to seek a comfortable occlusion, travels forward as it travelled backward before. The time to apply intermaxillary elastics is later and not until it is possible for the teeth to go together in their normal relation. I have seen cases of distal occlusion at fifteen to seventeen years of age, correct themselves by alteration of the relation of the arches.

The Overbite.

In regard to the overbite, later observations indicate that it is influenced to a great degree by the relation between the sizes of the upper and lower teeth—that is, the tooth substance in each arch. I found, quite a number of years ago, in measuring teeth—to my surprise (as it had not been my conception before) that the lower teeth do not have an exact constant relation in size to the upper, and in many cases absolutely normal occlusion is impossible. But the maintenance of the overbite in any certain position, depends a great deal upon the amount of tooth substance in the lower arch, as compared with the upper. We are to have a paper on that subject, and I am not going into it any further than to suggest that possibly the solution of some of the problems of the overbite, will be found in that relation. There is a certain relation between the size of the upper and lower teeth that should be constant, but we do not have it in all cases. Whether that can be overcome by changing the shape of the arch is a problem.

There is a sort of appliance for correcting the overbite, that I have found ideal. These loops, Dr. Pullen has shown, work nicely in many cases, and have the advantage of allowing free movement of the teeth—such as rotation, etc. Sometimes they bend down, and then I put a little support from the middle of the loop to the gingival portion of the band. If the loops are properly arranged—and I am sorry Dr. Pullen did not show that—the two central incisors will strike upon the two mesial bars of each of the loops, and the lower lateral incisors will strike on the outside bars. Thus you have the four lower incisors striking against the centrals. That will not do at all, in some cases, as the upper incisors will be intruded. That I have controlled in some cases where I have used the Angle Pin and Tube Appliance, by leaving the laterals included with the pin and tube, which has held them pretty solid; but I have one particular case in mind where the impact upon the centrals intruded them more than I wanted. But as the teeth came down into complete occlusion and the molars into contact, it seemed as though that reciprocal curve that Dr. Pullen has described, established itself. The movement of the jaw finally brought about an adjustment, such as usually occurs during retention. This is an adjustment which is difficult to control by any artificial means.

Some of these cases merely require the arches to be harmonized so that they can close in the proper occlusal relation. The habit of the patient may keep the jaw back until they have found their relation.

Dr. Federspiel. What do you mean by "found their relation?"

Dr. Hawley. I mean that it has become accustomed to moving forward in closing, to the point compelled by the new harmonious relation of the arches.

Dr. V. H. Jackson
New York.
The subject is intensely interesting. In our discussion we have overlooked two principles that we should not lose sight of. I brought these facts out in discussion in 1914 at the international meeting in England and at the meeting in Paris, and I thought that my friend, the essayist, would mention it in his discussion and relieve me of my thunder, but he did not.

The body of the lower jaw extends backward from the symphysis and joins with the ascending ramus; the latter extending upward forms a part of the glenoid articulation. In correcting the antero-posterior relations of the upper and the lower arches, as in the treatment and correction of prognathism, etc. we make a mistake when we claim that by force on the mandible we cause *absorption* of the distal wall of the glenoid fossa, or the *bending* of the *neck* of the ramus. Neither of these conditions occur to any extent from our treatment but, in reducing a prognathic condition by persistent force on the mandible with a chin-cap, the changes that occur are brought about in the bony structure at the anatomical angle of the mandible. Especially is this true with cases before adult age. This change of the angle of the jaw, by causing the ramus to be tipped forward, aside from the teeth being moved backward somewhat through the process in the line of the arch, when intermaxillary force is applied. and the forward movement of the whole upper arch, are the three principles involved in the correction of prognathism.

In cases of receding lower arch with prominent upper arch in its correction the change takes place at the angle of the mandible from the force exercised as with equalizing bands in applying equalizing force backward on the upper arch and forward on the lower arch.

This changing of the angle of the jaw is brought about by the apparatus being arranged to draw forward on the body of the jaw and is attached lower end of the ramus, while the upper end of the ramus is held by the action of the muscles and ligaments; thus the angle of the ramus from treatment in this manner is changed, being bent backward to a more obtuse angle.

To better understand these principles, we should not forget the changes that are taking place in the developing mandible; the changes taking place at the anatomical angle of the lower jaw are more apparent to one, when he remembers that the body of the jaw is continually developing forward between the erupted deciduous teeth and the ramus sufficiently for the accommodation of each successive permanent tooth in the arch, as for the eruption of the first, the second and the third permanent molars.*

It will be understoood by this progressive development in the body and at the anatomical angle of the ramus, that the jaw is continuously in a developmental state at the angle during all of the time of the eruption of each of the deciduous molar teeth to the time and after the first, second and third permanent molars are in place. While the region of the anatomical angle of the jaw is in this progressive development, it is readily changed in form by our treatment of prognathism, and by treatment of distal occlusion of the lower arch.

There are but a few instances in which the anterior movement of the lower arch by equalizing bands does not change the angle of the jaw enough to separate the lower arch from the upper, in the incisive region

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*Jackson—*Orthodontia*—Fig. 14.

sufficiently to cause the proper lap of the incisors, but if after the equalizing of the dental arches this change of the lap of the incisors is not sufficient for a good occlusion, the depression of the lower and sometimes of the upper incisors is indicated. The depression of the incisors is brought about by different means in my practice as by the introduction of a metal shelf attached to a regulating appliance, etc. In making the shelf it can be attached to any Jackson regulating apparatus in a comparative short time and the shelf be set at any angle most suited for the purpose.*

Dr. Ottolengui.

We have heard much of the inclined plane today, and with the modern methods of correcting teeth at our command there seems to be a lessening need for intermaxillary force. I was long associated with Dr. Kingsley, who was one of the first to use the inclined plane, and we were compelled to use the inclined plane without the assistance of intermaxillary force, for we knew nothing about the latter. I am a little surprised in all these latter-day talks about the inclined plane, at the smallness of them. These gentlemen must have patients much more docile than those that come to me. In cases requiring the inclined plane, it is hard to put one in which the patient will not bite behind and not on the plane at all; and it was for the treatment of that class of cases and to avoid putting a large and cumbersome mass of material in the mouth that I devised a method I will describe.

Flat Planes for Elevating the Buccal Teeth.

I cannot entirely agree with my friend, Dr. Rogers, that the arches should be made to conform first, before the use of a plane, because sometimes a great deal can be gained by using the plane very early. At least use a plane, if not an inclined plane. Where there is an excessive overbite, in which I wish to give Nature or my appliances an opportunity of elevating the distal teeth, in order to correct the lack of vertical development, I sometimes put in a lingual arch and on that lay a perfectly flat piece of clasp metal of about twenty-four gauge. That must be extended back far enough so that the patient cannot possibly bite distally of it. But it prevents a complete closure of the teeth yet does not open the mouth so much as to prevent the child from masticating. In some cases, where the overbite is very excessive you would open the bite inordinately if you put in an inclined plane im-

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*See *Transactions of the National Dental Association,* 1906, Figs. 18, 15, 8. Jackson—*Orthodontia*—Figs. 341, 342, 343, 344.

mediately. With the flat plane, should you need to retrude the anterior teeth, etc., that work can go on, because the lingual archwise can be sufficiently distal to the anterior teeth to allow this movement. It is a very comforting discovery, after two or three months treatment, to find that in spite of the fact that you have this plane in the mouth, all the bicuspids and molars are in occlusion. You then take the plane out, select another piece of twenty-four gauge plate, cut it smaller in the anterior curve, lay it on top of the first plane and solder it to place. Thus we begin to form an inclined plane. Sometimes I use three or four thicknesses, by which time I have the usual inclined plane.

It seems to me the use of the inclined plane attached to the front teeth is more of a retaining device than a corrective device. It is useful to hold the upper teeth back after they have been brought back.

When I first became associated with Dr. Kingsley he made his inclined planes on vulcanite plates, and I have seen any number of these plates completely eaten up at the distal portion by the persistence with which the patient would return to the distal occlusion. (We had no intermaxillary force.) For that reason and because I have abhorred vulcanites I begun to make roof plates of iridio-platinum and planes of iridio-platinum. I have seen these bend, although protected with a shelf, through the determined effort of the patient to bite back. Therefore I think there is an advantage in the method described, this graded building up from a flat plane to an inclined plane.

Intermaxillary Force.

It seems to me the most empirical method which we use is the rubber elastic. It is the one thing that is indefinite and we should know how much it is worn. We make the most beautiful appliances to carry these elastics and trust to God and to the patient's will and to the parents to have the child wear the elastics. Any number of good Sunday-school children come to me with the elastics on; yet they never wear them except in the office. I think some of our inventors should produce a definite intermaxillary force, which can be put on with a definite tension and which cannot be removed by the child. I have thought of the old-fashioned coiled spring such as dentists used for dentures long ago. Whether an iridio-platinum spring could be made of sufficient tension, I do not know. I think we should find a way to know between visits whether a child is wearing the appliance or not.

Dr. Summa.

I should like to ask Dr. Ottolengui a question. I understood him to say he uses an inclined plane of metal and it does not have to be in contact with the anterior teeth. How do you anchor it? How is it held in place?

Dr. Ottolengui. It is soldered to a lingual arch attached to the molars.

Dr. Summa. Addressing Dr. Ottolengui: That does not tip the molars forward, etc. Must it not be firmly attached?

Dr. Ottolengui. I have never seen the molars tipped. The front edge of the plane usually rests on the lingual edges of the incisors, but even where it is placed distally of the incisors to permit a distal movement, the plane resting on the soft tissues only, there has been no tipping. The truth is there is very little vertical stress upon the plane, even though it does act to keep the posterior teeth apart and thus permit vertical development of the teeth.

Dr. Carl Case. I wish to thank Dr. Pullen for his mention of the appliance introduced a number of years ago by Dr. Calvin Case, of Chicago, and called by him "the intruding and extruding appliance" because it was used for intruding incisors and extruding bicuspids, simultaneously.

I know positively, although I cannot prove it, that incisors can not only be intruded, but they can be held there, as I have models to show it, and I think Dr. Bogue has models of mine to verify it. The little spring wire used on these cases we have never called an expansion arch. It is usually twenty-three or twenty-four gauge, possibly smaller as we have found the resiliency of that small wire is sufficient to depress the incisors and elevate the bicuspids.

I will disagree with Dr. Lourie on the theory that sixteen thicknesses of band material is too much to use between the teeth. Just consider! Sixteen thicknesses of .003 of an inch each: less than five one hundredths of an inch distributed between twelve teeth. It is not a large enough amount to cause anybody any worry.

Dr. Abell. Just one thing has occurred to me as these men have been discussing this matter. Nothing has been said about habits tending to undo the work we have done in correcting the distal occlusion. In Class II, Division I cases, the lips come in between the lowers and uppers, and tend to drive the uppers out again. Dr. Ottolengui said he had found cases where the lower teeth would get behind the bite appliance. If you make your bite plane with a long bar for the patient to bite in front of, with little bars running up to the bands and extending a couple of points back of the bar so that the lips will keep away from it, the patient will keep the lips from between the teeth. The lower teeth will not go back of the main bar.

Dr. Casto. I have enjoyed Dr. Pullen's paper very much. We always expect and always get something good from him. I wish to say a few words regarding the thing that really makes the orthodontic work successful, that is *"Function."* In cases of excessive overbite the masticating apparatus is thrown more or less out of *Function*. The development of the bone will therefore be abnormal in proportion as *Function* is interfered with. In some parts there will be an overdevelopment of the bone while in other parts there will be an underdevelopment. In the case of excessive overbite there is a relative overdevelopment of the bone in the incisal region, and an underdevelopment in the molar and bicuspid region. In the treatment of these cases, there is no doubt in my mind but that the incisor teeth are intruded, and the molar and bicuspid teeth are extruded. In other words the occlusal plane is changed. If in a given case the correct occlusal relations have been established and maintained, and *Function* restored, the intruded incisor teeth will bear the same relation with the molars and bicuspids in the occlusal plane as when the correction was made. It is perfectly obvious, however, that if *Function* is not maintained the teeth will return more or less to the original position. *Function* is an absolute necessity to the life and health of any organ, and must not be overlooked in the consideration of an orthodontic operation.

Dr. Juvet. I would like to ask Dr. Pullen if, from his observations he has any proof of how much he intrudes the incisors and extrudes or pulls the other teeth out? Which one gains the most, the teeth going in or the teeth coming out?

Dr. Weinberger. The influence of and the use of the bite plate in "opening the bite" to me is questionable. In those cases where we endeavor to overcome the short bite it is necessary to widen in the posterior region by straightening the deciduous molars, premolars or molars as the case might be. Upon closely examining those cases you will find that nearly all the posterior teeth are tipped lingually and if these are allowed to remain in that condition or the arch widened without rightening, the use of the bite plate will never be of value. If you succeed in rightening these teeth, then there is no need of the plate. The greatest difficulty in all those cases is the almost impossibility of tipping the first molars or premolars buccally so that they can assume their normal position. Then again we must take into consideration the shape of those molar teeth, the inclination and the height of the buccal surfaces in comparison to the lingual surfaces. This condition we often come across and when present the use of the bite plate will not help matters.

Dr. Pullen. I am glad to have such a splendid discussion of this subject of the abnormally deep overbite. I anticipated learning more from the discussion than you would from the paper itself, and I have not been disappointed.

Dr. Rogers spoke of a method of treatment of the abnormal overbite which has been used by several men, probably unsuccessfully. This method of treatment of the abnormal overbite was experimental as I published it, and if anyone was tempted to try it they would find in it the same difficulties that others had found who tried it before, i. e., the building up of the deciduous molars with gold crowns to open the bite and putting on appliances to extrude the first molars and in that way change the height of the occlusal plane and restore the normal overbite. I confess that this method was an absolute failure in my hands, and I think in the discussion it has been shown to be a failure in the hands of others.

Dr. Young. I have had success in some cases and failures in others.

Dr. Pullen. Dr. Rogers spoke of taking up the treatment of the cases of abnormal overbite in Class II, at different stages, with the possibility of getting better success at one stage than another. Of course we get these cases in the deciduous denture, and we have the difficult problem Dr. Hawley has brought before us to-day in the inharmony in the sizes of the teeth of the upper and lower arch. And I will say, if this is true generally, if there is such an inharmony in size, in the widths, of the tooth substance of the lower and upper dental arches, the whole fabric of etiology and treatment of Class II is sadly deficient. But we have our records of successful treatment of many of these cases. So we need not be quite so discouraged as to results in the average case.

Abnormal Overbite. In Dr. Lourie's discussion, he asked a number of questions, among others, "What is the abnormal overbite?" I attempted to define it by defining the normal overbite, as the relation of the incisors and cuspids below the linguo-gingival ridge, but I did not mean to infer that anything below that linguo-gingival ridge is absolutely normal, because there are cases which certainly do not look incorrect even though just below the linguo-gingival ridge. It is hard to make an absolute definition of either the normal or abnormal overbite.

Dr. Lourie also spoke of the incisor overbite not always being proportionate to the length of the cusps of the bicuspids and molars. Bonwill brought out this relationship in his attempt to work out an ideal articulation, and he thought this relationship was absolutely normal, but there is no doubt that the relation is more ideal than absolute.

Dr. Lourie mentioned the probable location of the maldevelopment when the two casts were opened in a vertical direction, as shown in the height. I indicated that lack of development or maldevelopment, existed in the molar and bicuspid region, but I did not intend to say there were no other features of maldevelopment in the case.

Distal Occlusion.

In speaking of the distal occlusion as being only an incidental factor in Class II, I gave the reasons for that in my paper and see no reason for changing my mind in this particular; and I think you will probably agree with me that in all of the Class I cases, with upper protrusions which appear exactly like Class II cases except for the distal occlusion, you must treat them exactly like Class II cases: and if that is true that should be sufficient to indicate that the distal occlusion is an incidental factor. However, it is important enough to take cognizance of, that the overbite may be caused originally by the distal occlusion, as Dr. Lourie suggested. Dr. Lourie spoke of the danger of opening the bite in Class II, Division II, with intermaxillary force in some cases. Happily, that occurrence has never occurred to me. I would be willing to undertake the chance of getting an open-bite in any of those cases I have ever treated. I have never yet obtained such a result. That may be my good fortune rather than otherwise, however.

Use of the Lingual Arch.

There are many points I would like very much to have Dr. Lourie bring out in relation to the lingual arch. I am sure he knows more about it than others who have given it less study. In working with the lingual arch in Class II cases (Division I) in the lower arch, my reason for not making that arch "fixed" was that there was an important principle involved. If we use intermaxillary force between the upper and lower arch in those cases it is impossible to get the power of the intermaxillary force where you bind down the molars with a soldered lingual wire, and I was simply getting rid of the fixation of the molars where I thought it would be advisable to do so. One can apply the lingual arch in a pivoted tube and the molar teeth can work more freely than if bound together with a soldered arch. In that connection also is the idea that Dr. Lourie suggests that the lower teeth will be more mobile, and that perhaps we would tip the lower molars mesially much more easily than we would if the lingual arch were fixed. As a matter of fact, I believe that with the lingual arch arranged against the lower incisor teeth we have enough pressure against the molars to keep them in an upright position. I have not had trouble in tipping the molars mesially, but I have attached the hook at the mesial angle rather than the distal, so as to attach the elastics to better advantage.

Dr. Lourie also spoke of not quite understanding a paragraph in the paper concerning the use of the inclined plane for correcting the abnormal bite but not for correcting the occlusal plane. That does sound rather ambiguous, but I meant that this inclined plane, whether on rubber or gold, I did not use in the same way I did the later described planes for changing the occlusal plane with a double elastic lever.

Bands on Teeth.

There seems to be some objection to the appliance I described and illustrated, using the reciprocating elastic lever expansion arch, which was used in a number of ways. I think Dr. Case answered that very well, in saying that with sixteen thicknesses of .003 inch band material you have very little addition to the tooth width, and another point, in the upper arch, after treatment, the bands are taken off and the teeth will settle back closing up the space. The same argument would hold good in the use of the bands for the new Angle appliance, unless made as suggested by Dr. Young, so that they would not occupy any appreciable space between the teeth, which is the proper way to make them.

In Dr. Jackson's discussion he gave us a theory I have never heard before, in the possible bending of the rami in the use of intermaxillary force, which would lower the teeth in the incisor region and change the overbite. I can believe it possible that in a very long period of treatment any force would change the relationship of the teeth and possibly of the bone, but I cannot conceive of that theory being one we can adopt with any degree of assurance.

Dr. Juvet asked which is greater, the intrusion of the incisors or the extrusion of the bicuspids. In answer to that I think there is about an equal amount of extrusion of the bicuspids and intrusion of the incisors.

The Development of the Alveolar Process.

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

One of the most important factors related to orthodontia is the development of the alveolar process and it is because of the misunderstanding of the alveolar process and its development that we have consented to give this short report of what we have found in regard to these structures. The microphotographs used in illustrating this talk were made by Dr. F. Hecker of Kansas City, from some studies which he has been making upon development including the alveolar process and the peridental membrane. From studying a large number of these histological specimens we found that the ideas in regard to the alveolar process as described by some of the writers and as described in some textbooks did not exactly tally with the embryologic and histologic evidence shown in the histological specimens.

Previous Theories in Regard to Alveolar Process.

The alveolar process has been defined as that bony structure of the mandible and the maxilla which supports the teeth. It is supposed to be developed for the teeth and that its sole purpose is the support of the teeth. We find as a result of this description that a great many men have formed the idea that the alveolar process is something distinct and separate from the rest of the jaw; has a different histological and osseous structure, and therefore, that it is not true bone. The statement has been made many times that the alveolar process is not bone; if it is not bone under what group of histological tissues would you place it?

In order to understand the development of the alveolar process you must go back and consider the development of the body of the jaw, and as the mandible is more easily described than the maxilla we will confine our description to the mandible.

The Author's Views.

We find, however, that the alveolar process is developed for the maxilla the same as it is for the mandible, of course, assuming a different shape owing to the anatomical shape of the part involved. The mandible develops from the first branchial arch and very early in the process of development there is laid down a cartilaginous structure which you are all familiar with known as Meckel's cartilage. There is probably no part of the mandible which has been accused of so many things as Meckel's cartilage and which has been so greatly misunderstood. Meckel's cartilage is the primary cartilaginous structure of the mandible and does not form any part of the alveolar process. I have never seen an histological specimen that showed Meckel's cartilage, except the distal part of the osseous structure of the body of the mandible. About this stage there begins development at the seat of the structure which shows the development of the enamel organs which gradually embed in the mesoblastic tissue, and from the mesoblastic tissue there develops the dentinal papilla.

Somewhere approximately midway between the dentinal papilla and the Meckel's cartilage there begins to develop an intermembraneous bone formation which is the first evidence of the formation of osseous structure in the body of the mandible. This bone is an intermembraneous formation and is laid down by the activity of the osteoblastic cells which also make their appearance before the formation of any periosteum. This then shows that the osteoblastic units are given off from the mesoblastic structure and are not dependent upon the periosteum or peridental membrane for their existence.

Periosteum not Necessary to Alveolar Bone Construction.

I mention this fact because if the original osteoblastic unit can make its appearance without a periosteum or peridental membrane, why would it not be possible for the succeeding units to so make their appearance? In other words, the periosteum and the peridental membrane is not necessary to formation and future growth of the body of the mandible or the alveolar process. In other words the periosteum and the peridental membrane are not the original osteogenetic factors and are not osteogenetic factors to any great extent, if at all, during the adult life of the individual. We have never seen any evidence to lead us to believe that in the development of the alveolar process either the peridental membrane or the periosteum had anything to do with it.

By going back again to the embryological development of these parts we find that the cancellous constituents of the bone which are forming in the body of the mesoblastic structures continue to develop in various directions so as to form a mechanical support for those parts. We find what may be termed the labial and lingual portions of this occlusal border of those bones going upward and developing and closing about the dentinal papillæ and the enamel organs till we finally find the tooth lying in crypts. This so-called crypt is the primary beginning of the alveolar process and has been developed to support and protect the tooth just as the alveolar process will be developed later in adult life.

As the tooth continues to grow and the individual continues to develop, the mandible and the maxilla are increased in size through the activity of the osteoblastic units some of which lie on the external surfaces of the bone underneath the periosteum which has led some men to think that the periosteum has an osteogenetic function. We find at the occlusal portion of the dental crypt as the tooth begins to erupt that these osteogenetic units, or osteoblasts as they are called, continue to form bone on the edge of the dental crypt thereby carrying the dental crypt occlusally as it continues to grow. Not until after the eruption of the tooth can we say that a peridental membrane has developed, for the space between the tooth and the dental crypt is filled with a mesoblastic connective structure, which has been termed a dental follicle, and from this dental follicle is formed the peridental membrane later in life.

We are particularly calling attention to the fact that the alveolar process is an osseous portion of the mandible and the maxilla and is developed by an activity of the osteoblast and does not depend upon the peridental membrane or the alveolar process for its development. Also the alveolar process is an intermembraneous bone formation similar to the intermembraneous formation which is primary and takes place in the body of the mandible. (Dr. Dewey showed lantern slides in support of his contentions.)

Discussion of Dr. Dewey's Paper.

Dr. Federspiel. When I received the letter from Dr. Flint saying that I was to open the discussion on Dr. Dewey's paper I immediately wrote Dr. Flint a letter informing him that I could not very well discuss Dr. Dewey's lecture. Dr. Dewey's report is on research work that he has been doing during the past months. In order to discuss his talk in an intelligent way it would be necessary to be familiar with his work. Dr. Dewey's report is somewhat of a revelation to me, because I have always believed that the periosteum played an important part in the development of bone. This has been forcibly brought to my mind sometime ago when a man reported at my office in December, 1915, complaining of swelling of the mandible in the region of the third molar. After making a thorough examination of the case I came to the conclusion that this patient was suffering from a suppurative ostitis involving the ramus of the mandible up to the joint. In order to establish a cure I proceeded to operate on him by making an incision below the mandible and separating the periosteum from the entire diseased bone; then, by means of bone forceps, I removed the entire area sub-periosteally. The gloved index finger was then inserted into the wound and the field explored. The periosteum was found apparently normal, with this exception, that there seemed to be a gritty, bone-like feel over several parts of the inner layer of the periosteum. Iodoform gauze was then packed in this pouch and the wound dressed and the remaining jaw immobilized. Three days later the gauze was removed with no sign of pus; wound repacked and removed again forty-eight hours later and the wound left to heal by granulation. Six weeks later the patient was discharged to report from time to time. After a period of six months sufficient bone had regenerated within the periosteum so as to give him a fair form, without any disfigurement to his facial lines. I am confident that if the periosteum had not remained it would have been an impossibility for this bone to reform and I am quite confident that the periosteum played an important part in permitting the bone to regenerate.

Dr. Summa. Did you cut it clear away?

Dr. Federspeil. There was nothing to cut away, the entire diseased area sloughed out. By that I mean, that it had separated from the periosteum and was lying within the soft tissues as a foreign body. Upon removing this dead bone we immobilized the remaining portion of the jaw with an orthodontic appliance. I have always believed that bone is reproduced from the periosteum. If Dr. Dewey is right in his contention then I believe that the reason the bone did regenerate was because there were islands of osteoblasts lying under the periosteum to develop the bone. Dr. Dewey's theory is new to me and goes to show that we have to do considerable research work in order to establish facts relating to bone growth.

Dr. Summa. Anyone asked to discuss a paper of this nature, without a warning of what is to be presented, is rather at a disadvantage. I am somewhat familiar with the teachings of Dr. Wm. MacEwen, of Glasgow. He argues against the claim that the periosteum is concerned in the building of bone. However, I am not yet convinced of this.

We are always seeking "the one cause" for things. It has again been sought and apparently found. Why is it impossible that both marrow and periosteum are carriers of bone forming cells?

I am not ready to refute the illustrations and findings of Dr. G. V. Black in regard to the functions of the periosteum and the peridental membrane because of the pictures which Dr. Dewey has shown. Higher magnifications of smaller areas should be presented. The essayist may be able to prove his contention, but these slides are not conclusive.

Dr. Dewey has stated that there is no cartilage bone in the mandible. I have formerly made this same statement. However, I have recently been shown convincing evidence to the contrary in the form of seventy consecutive microscopic sections of the mandible of a human embryo, which were made by Dr. E. McEwen at the State University of Iowa. These sections demonstrate unmistakably the presence of cartilage bone under the attachments of pterygoid muscles.

Dr. Cryer. I did not expect to hear such a paper from Dr. Dewey. I saw that he was down for the "Development of the Alveolar Process" but he has treated it differently from what I expected. Not that I have not been exceedingly interested in the ground he has taken, but I was in hope of hearing him take up the development of the alveolar process, the cause of its development, whence it came and whither it led. I indorse everything he has shown on the screen and all his remarks in regard to the regeneration of bone.

Dr. Summa and Dr. Federspiel are right in saying that many of the works on surgery take the ground that the growth of bone depends to a great extent on the function of the periosteum and marrow. See W. W. Keen's latest work on Surgery, also Park's Surgery, third edition. On the other hand MacEwen of Glasgow and Williams of New York believe that the periosteum has no osteogenetic function.

Last November at Syracuse I read a paper before the Union meeting of the Fifth, Sixth, Seventh and Eighth Districts (N. Y.) Dental Societies. Upon *"Some Clinical Observations of Regeneration of the Mandible After Caries and Necrosis."* This paper will be published in the *Dental Cosmos* of August, 1916.

I took the ground in that paper that the periosteum has little or no osteogenetic function and also gave illustrations showing where not only a part of the side of the mandible, but where more than one-half of the mandible had been removed and new bone had been formed.

I will speak of one interesting case. The patient happened to be a prominent business man of this city (Pittsburgh). The first examination disclosed a complete separation of the mandible in the region of the premolar teeth. The bone, and apparently the periosteum, had been lost in the region of the second premolar.

The bone around the first premolar was in a necrotic condition and each end of the bone of the mandible on either side of the necrotic area was quite loose and independent of the other, mastication was impossible and speech was very much interfered with.

Treatment. Casts were made of the upper and lower teeth; the lower cast was cut out in such a way that the lower teeth could be brought as nearly as possible into normal occlusion, the cast was fixed by plaster of Paris. A bridge splint was made for the lower jaw and cemented on, leaving a space that I could work down through and treat the wound. That splint was placed on the first of June, and the condition treated. The parts closed: bone regenerated and formed a complete union from the second molar to the canine tooth. I know that every particle of periosteum was cut away, or lost and by the first of January the following year the bone was as solid as that table. The alveolar process, by the way, was not rebuilt, because the stimulus to build it, the teeth, had been lost. I would like to hear Dr. Dewey explain the relation of the teeth in producing or reproducing the alveolar process.

Dr. Ottolengui. Does the bone that grew back, have any periosteum?

Dr. Cryer. I have every reason to believe that it has. In the Second Edition of my book on *"The Internal Anatomy of the Face"* you will find this referred to. I have frequently had X-ray pictures made of cases showing the bone diseased all the way through, pitted, and have cut down on the bone and found no periosteum whatever. Occasionally when teeth lay at an angle even of forty-five degrees in the jaw, I have known them to become firm by regeneration of the mandible, through the process Dr. Dewey has given you.

Dr. Ottolengui. Did you say that the periosteum grew back, or not?

Dr. Cryer. I think it does in many cases where the bone has completely regenerated.

Dr. Federspiel. Why, in many cases of suppurative ostitis, where the bone is degenerated and sloughed, do you find spiculæ of bone attached to the periosteum?

Dr. Cryer. I think Dr. Dewey explained that by the osteogenetic membranes—I call them osteoblastic units. Where this osteogenetic unit has worked to the periphery it has developed these spicula osteophytes.

There was an interesting paper written about 1791, by a French surgeon, who reports four cases of regeneration of the mandible, which are very remarkable. They are recorded in the *Journal de Medecine,* Paris, 1791, and it would be well if you could get that article. Dr. Kirk has a copy from which I quoted in the paper alluded to previously.

It gives me much pleasure to be here and it is most interesting to have heard Dr. Dewey's paper.

Dr. Abell. I am not able to discuss this from the standpoint of the microscopist or the scientist, but I came across this in a textbook on bone grafting, that (as I said this morning) a trellis of bone will bring about a bone growth when the periosteum is not there, and to demonstrate that, is conclusive evidence that the periosteum is not necessary for the growth of bone. The osteoblasts will work out through the canals of the bone, and build bone and reabsorb this trellis of bone, and this bone may be boiled beef bone, bone of the cadaver, autogenous periosteum, covered bone, etc. The chances may be better for the new bone to be formed, and an absence of necrosis, if the periosteum is present.

Dr. Summa spoke of one case where he failed to get bone union, and it occurred to me that perhaps a case in point would be to say that those who do bone grafting have to be careful to have a juxtaposition of the bone graft and the bone itself, and no blood between, etc. A good adaptation is necessary.

Dr. Mershon. I would like to ask Dr. Dewey, if the peridental membrane has no osteogenetic function, to what does he attribute the cementum of a tooth?

Dr. Abell. A case in point, is that thin bone forms on the outside as a splint, because with the force and pressure brought to bear, diseased bone will not bear it, and nature forms a splint to perform that office.

Dr. Dewey. Dr. Mershon has asked as to the origin of the cementum, and that brings up the question I have been working on with Dr. Hecker, and I have under preparation a paper dealing with the origin of the cementum, which is as revolutionary as this in regard to the origin of the alveolar process. Cementum is modified bone, and it takes a very expert man to differentiate a histological section, if magnified sufficiently—of cementum from the alveolar process. I have sections of the end of a broken tooth. It shows the development of the cementum at the broken end of the tooth, and shows it is not coming from the peridental membrane, but from preexisting cementum coming from the embryonic cell, the same as the bone corpuscle comes from. That is a subject to be published later.

Dr. Summa is not ready to accept the statement that the periosteum has nothing to do with the development of the bone. If we could have him in Dr. Hecker's laboratory a few hours we could show him all the evidence he wound want.

With regard to Dr. Federspiel's statements that you may find islands of bone on the periosteum. Those have been originated from osteoblasts or corpuscles, hanging around somewhere on the live bone, and which have not yet succumbed to the infection. The entire tibia of a dog has been removed and the periosteum stripped off from end to end. The bone remained vital and new periosteum, or tissue, developed over it.

The function of the periosteum and of the peridental membrane is that of a "limiting" membrane; to limit the growth of the osteoblasts, etc. It has function, as ordinarily regarded, with due respect to Dr. Summa. In the case of the cementum, the peridental membrane limits the growth of the cementoblasts.

Where a necrotic condition has destroyed a portion of the process and the peridental membrane, you may have hypercementosis of that region. The cementum comes from the preexisting cementoblasts.

A Member. Will Dr. Dewey answer Dr. Cryer about the alveolar process developing as the result of stimulation from the use of the teeth?

Dr. Dewey. In the first place I have to disagree probably with my friend Cryer, and I have also to disagree with Dr. Hecker as to what the alveolar process is. Some men say it is not bone. Hecker says that, as some of you know. I come back at him and ask him, what is it? It is not connective tissue, cartilage nor nerve tissue. It is not a calcified connective tissue; it is not Haversian system bone and not compact bone. It is a cancellous structure developed for the support of the teeth; and as a result, it disappears with the teeth. It springs from the osteoblasts which continue to develop along the tooth as it grows upward. Through the stress falling on a tooth after it breaks through the gum, you get a change in the arrangement of the fibres of the peridental membrane— a change in the action of the cementoblasts, etc.... If you have a condition in which the periosteum comes in contact with the cementum of the tooth, as you sometimes have in diseased conditions—if you get a condition where the periosteum is in contact with the peridental membrane, and those tissues are bridged across, you have no more development of the alveolar process in that region, as the tissues of the peridental membrane on one side and of the alveolar process on the other side, limits that.

There are many things regarding malnutrition with reference to constitutional disease that will affect the development, of which we know but little. There is enough of this one subject as to the development of the alveolar process, the function of the peridental membrane, etc., to spend several hours on, and for which we have too little time.

Dr. Cryer. Dr. Dewey says it is not bone—it is not cartilage! What is it? He tells us what it is! It is "alveolar process!"

American Society of Orthodontists and The American Academy of Prophylaxis and Periodontology.

Joint Session.

Practical Measures of Preventive Dentistry for the Orthodontist.

GRACE ROGERS SPALDING, D.D.S., Detroit, Mich.

In these days of advanced scientific attainments it is not unusual for a dentist to become so absorbed in the scientific department of his profession that he is inclined to belittle the importance of the art or practical phase of it. We have nothing but complete admiration for those men whose minds are qualified for the painstaking, persistent, self-sacrificing work of the scientist, whose training has been such as to enable them to understand and to make comprehensible to us the results of their research and to suggest the possible application of these results. In music, some of our most wonderful composers have not had the technique to render their own compositions. As is well known in dentistry, some of our greatest scientific men have not excelled in the technique of operating. Of what use would musical compositions be without the artist to interpret them? Would the solution by our research committees of the most intricate problems in dentistry be of much benefit to our patients without their practical application? It remains for the artist to apply that which the scientist discovers. They are interdependent, each one being necessary to the other. As a noted scientist has said, "The object of science is knowledge; the objects of art are works. In *art,* truth is the means to an end; in science it is the only end." It is only by the dental artists and the dental scientists mutually recognizing the value and skill in each other's work and by complete co-operation that we will finally attain the goal of preventive dentistry for which we are so earnestly striving.

This alluring goal has been made more nearly possible of attainment by the splendid work of the American Society of Orthodontists and the ideals ever present in the minds of its members. The writer has often wondered if orthodontists fully realize just how great has been their contribution toward this end or how many opportunities are still within their grasp?

It is difficult for a specialist in our profession to obtain from the general practitioner that complete co-operation which is so essential to success in the ultimate result. There is no specialty of dentistry which is so dependent upon correct dental restorations as orthodontia. In other specialties faulty dental operations are usually recognized before irreparable injury has been done, while in orthodontic cases the shifting of teeth back to their original positions, due to faulty contour, defective contacts and imperfect occlusal restorations is usually so gradual that the occlusion of the teeth may be changed and the purpose of the orthodontist's work entirely defeated before this is discovered.

To offer a solution for this problem is exceedingly difficult, since there will always be dentists and *dentists*. As dental art advances the technic of the individual operator will naturally improve, but the writer believes that the inevitable solution will eventually be the prevention of all cavities for orthodontic patients during as long a period of time as the patient is under the observation of the orthodontist. After this there should be but little difficulty in preventing caries, for such a patient would probably give his teeth, which would then be in normal or nearly normal occlusion, that intelligent care which alone can and does prevent dental caries. If only the oral prophylaxis specialists and the orthodontists could co-operate to such an extent, and together care for a sufficient number of cases to verify conclusions, according to our present enlightenment in this direction the result would be a step forward in preventive dentistry. But this is verging close upon idealism, and we were to consider "Practical Measures of Preventive Dentistry for the Orthodontist."

It has been the good fortune of the writer to study and observe a considerable number of patients, most of whom were children in the hands of various orthodontists before, during and after treatment. The conclusions arrived at was this: that the orthodontist is not responsible (as he is sometimes accused) for all decay that occurs upon teeth which he treats, but that the cavities he can prevent are legion.

Prophylaxis Necessary Prior to Affixing Appliances.

Orthodontic appliances are frequently placed upon teeth and in mouths in no condition to receive them. This alone is responsible for many cavities which develop during treatment. Roughened enamel surfaces so frequently found on children's teeth are impossible to cleanse with any equipment available to a patient. Is it not reasonable that any appliance placed in a mouth where there are such surfaces present would add to the difficulty of the cleansing process? It has been demonstrated by the method of oral prophylaxis that highly polished enamel is easily cleansed and that bacterial masses attach themselves with greater difficulty to such a surface than to a roughened one. Therefore it is suggested that, whenever feasible, the teeth of an orthodontic patient should be carefully and thoroughly polished according to oral prophylaxis standards before a single appliance is placed upon those teeth.

Necessity for Training Children in Care of the Mouth.

Neither should a regulating appliance or anything which increases the difficulty of caring for the teeth be placed in a mouth until it is positively known that the patient (or his guardian) understands the care of his teeth. It is a well-known fact that few adults effectually care for their teeth. It is equally true that many children do not understand just what they are doing with a tooth brush; consequently, the care their teeth receive is indifferent, to say the least. Then, too, the orthodontist treats children at a time when both cleanliness and Godliness are almost strangers to them, so that it is exceedingly important that children in his charge should be thoroughly and specifically instructed with regard to the care of their teeth and be given efficient tools with which to work.

Protection of Erupting Teeth.

However, it is impracticable to prevent the decay of pits and grooves (particularly upon occlusal surfaces) when so formed as to invite decay, in a susceptible mouth, by the use of any known mechanical measures in the hands of patients during the eruptive process of the teeth. It is especially difficult to care for occlusal surfaces of erupting teeth when regulating appliances are in place, particularly the bicuspids and molars, owing to their position, and to a more or less inflamed and hypersensitive condition of the gum tissue surrounding them. This irritation is especially noticeable where the use of wire ligatures is demanded. Therefore it is recommended that whenever practicable, erupting teeth should have all grooves and pits protected by a layer of oxyphosphate cement *as soon as they are accessible,* and before there is the slightest opportunity for even an etching of their surface. This should be repeated as often as demanded until the teeth are in occlusion, when if there has been no previous break in the enamel and the patient understands the care of them they are practically safe.

The method of filling these pits and grooves has often been explained, but its repetition will do no harm. Carefuly polish the exposed surface of a tooth to be protected. Wipe with absolute alcohol and dry with warm air. Mix an oxyphosphate cement quite heavy, bearing in mind that it must be thin enough to flow to the extreme base of all pits and grooves and not bridge across them. The cement is carried with a fine probe. If the surface appears to require especial treatment it is good prophylaxis to apply $Ag\ No_3$, being careful to wash all away before drying off with alcohol. This operation of protecting occlusal surfaces must necessarily be as carefully done as that of filling a cavity in order to be a success as a preventive measure.

Cavities Occuring After Orthodontic Treatment.

Many cavities develop within a few years after orthodontic treatment is completed upon a case, and these are often explained as the result of a "let up" on the patient's part in the care of his teeth. This may be true in some instances, but many are the direct result of etched enamel caused by wire ligatures, unrecognized loose bands, undisturbed bacterial masses and improper care of the teeth during the time when the orthodontic work was in progress. For this reason it is very necessary that before retaining appliances are attached and before any case is finally dismissed the orthodontist should insist upon the teeth being again treated according to oral prophylaxis methods. This process if carried out promptly will prevent many cavities which would otherwise be sure to develop within a few years.

Areas Specially Liable to Decay.

There are areas particularly liable to caries during orthodontic treatment which only constant vigilance on the part of the patient and orthodontist can prevent. Such surfaces are, viz: Mesial and distal of upper central incisors and proximal surfaces of permanent teeth temporarily not in contact. The especial liability of the upper central incisors to decay may be partially explained by the fact that so frequently a single band is necessary for regulating or retention on one of the four upper incisors. This evidently changes the contact of the centrals so that food particles are caught and held and bacterial plaques attach themselves with greater ease. If these teeth are daily given especial attention with polishing tape, caries can be prevented.

Coating and soft deposits easily accumulate upon an approximal surface facing a space, and unless these surfaces are effectually cared for decay often occurs. Some means must be devised for keeping these surfaces clean. Dental floss carrying an abrasive is often practical for this purpose.

If it should become necessary that a patient be taken away for a time during orthodontic interference before he leaves, an especial examination of the teeth should be made to see that pits and fissures are well protected with cement; to touch any spots of incipient decay on posterior teeth with silver nitrate; or if on accessible areas they should, if possible, be polished off and not allowed to develop into cavities, which would otherwise probably occur before the patient's return. But you are about to inquire, "Who is going to do this preventive work and be responsible for it?" If the dentist who referred the case appreciates its importance, and is qualified to render the detailed service which this work demands, and if he is willing to give it the time required, then he it is who should be made responsible. But if he is disinterested, or too busy or unwilling to co-operate with the orthodontist, then without any question it is justifiable to place the patient in charge of a dentist who is competent to render such service as is needed.

Children's Dentist Advocated.

It is to be hoped that the day is soon at hand when every orthodontist will have within his reach a dentist who devotes his entire time to the care of children's teeth, and that it will be generally understood that when a child is placed in an orthodontist's care he also will be given over to the children's dentist, who will, of course, be especially trained to do any preventive work as well as operative work required; who will use materials and methods particularly suited to children, and who will have a complete understanding of child psychology. Satisfactory dental services for children is at a great premium, because it requires endless patience and perseverance, a genuine sympathy with and understanding of these little patients and is a great time consumer. If one is especially adapted to such work and is trained for it, then these difficulties are minor ones and controllable. The development and establishment of such a specialty would be the best solution for the problem under consideration. The next best solution would be co-operation with an oral prophylaxis specialist. Under the existing conditions this latter suggestion is worthy of your attention. Complete co-operation from the oral prophylaxis workers would be easily obtained because of the gratitude they all feel toward orthodontists who are so materially aiding them in their work.

It is a well recognized and established fact that malocclusion is one of the greatest factors favoring disease of the periodontal tissues. Each case which you treat successfully is placed in a condition to effectually resist periodontal diseases if the environment of the teeth is reasonably clean and tooth restorations or replacements closely approximate the normal. This is invaluable to those who are devoting their efforts exclusively to preventive dental measures.

Co-operation.

Anyone who has had experience in limiting his efforts to one line of work knows how great is the difficulty of obtaining the co-operation of cooperators on a case. However, without this he cannot succeed, will disappoint those whom he serves and will fail to render that especial service for which his patients are compensating him. Hence it is his privilege to demand whatever co-operation is necessary, from co-workers as well as patients.

The orthodontist knows that the effect produced upon the teeth by his treatment is but a part of the result he accomplishes. However, patients and dentists more frequently judge him by this one result than any other. For this reason it would seem advisable to adopt the foregoing or similar suggestions whenever feasible and practicable.

Any suggestions which have been made are not offered with an attitude of criticism, but are prompted entirely by a desire to aid if possible the worthy orthodontist to more nearly attain his ideal (as regards the teeth)—a set of *real* teeth restored to normal occlusion.

Discussion of Dr. Spalding's Paper.

Dr. Ottolengui.

At the outset, Dr. Spalding said she has had the good fortune to study and observe a great many cases that have been in the hands of orthodontists, and she is able to state that not all of the caries in the mouths of children having their teeth regulated is really due to any practice or malpractice on the part of the orthodontist. I think this is entirely true, but I think also there is a great tendency on the part of the general practitioner to attach this blame to the orthodontist.

I think the Doctor's advice that the mouth should be put in thorough order before any appliances are put on is not only sound from the standpoint of the patient, but peculiarly so from the standpoint of the orthodontist. Suppose a patient comes to you with undetected incipient caries in the molar region, and after the teeth have been banded for five or six months, and they are then removed, a large cavity results. You would be held responsible. Therefore I entirely agree that the teeth should be scrupulously examined for caries before treatment is undertaken, and that the mouth should be made as free from caries as possible before work is started.

Dr. Spalding recommends protecting the sulci in the morsal surfaces of erupting teeth, and I think that is an eminently wise precaution. Of cause, Dr. Spalding will not expect me to agree with everything, and I do not agree with the use of nitrate of silver. I do not think it should be used where there is no caries, and in incipient caries I think you will get a stain which will compel you to make the cavity larger than otherwise would be necessary. I believe that in this day of the wonderful synthetic cements we are safe to cut out the actual danger spots and fill with synthetic. I think that will last as long and save the tooth as well as the nitrate of silver will, and if subsequent filling is necessary we will save the tooth unstained and it may be more beautifully filled permanently.

We are constantly face to face with the question, "Doctor, is it true the teeth will decay while being regulated?" You have all heard that question. The observation in my practice has been that the children who have had their teeth regulated in my office have less caries than those who come to me for fillings. The latter only come when they need a filling. The rest of the time they are careful to keep away from my office; but those having their teeth regulated, under our office rules, have their teeth cleaned to some extent at every visit.

I applaud with both hands the sentiment, "The patient must be protected rather than the interest of the dentist who sends the patient to you," and as this is a joint meeting I will touch on another matter, because it will be addressing the other branch of specialists present. Just the same as I believe it to be the duty of the orthodontist to protect his children from caries, regardless of the parent's predilection for some particular dentist, so do I also feel that the periodontist should not feel called upon to send his patient back to the recommending dentist for root canal work, when the radiograph shows that he is incompetent to do it. Either of you, the orthodontist or the periodontist, is assuming the responsibility for a cure of the case. Now you must have the co-operation of competent adjutants. You must have faith in the person who is to do the other work, or you must do it yourself. The periodontist should absolutely include the treatment of the inside of the tooth quite as much as the outside. You should say to the recommending dentist, "I cannot cure a periodontal disease unless I can also remove the infection within this tooth." The orthodontist can say, "Yes, my friend, you may put the gold filling in the tooth when the patient comes back to you, but while in my care I am going to see that decay does not occur or progress, even if I have to fill these teeth with some substance myself."

Dr. Flint. It has been my pleasure to follow the writings of our essayist for several years, and I have obtained much comfort in the past in the hope I was doing *some* real service to my patients in restoring normal occlusion and thereby putting the patient in line for a clean mouth and also for the resisting of caries.

Only two weeks ago I met a teacher, and he said there was no reason why we should have dentistry broken up into any specialties, excepting only orthodontia. I could not agree to this for a quarter of a minute, and I want to express the view that the periodontist is here to stay, and I hope the day will soon come when every orthodontist can have one in his own office. You all know, as well as I, that you will do the work you like best to do, and sometimes you will neglect that which you do not have any desire to do. There is not a man in the room here that would find any pleasure in mending a broken plate, because he can get some one else to do it, and who would perhaps do it better than he could.

Only fourteen years ago we put many a clamp band on without any cement! That was bad teaching, and we had more or less trouble with our molars, but with the advent of the plain and cemented band we have eliminated that trouble.

I hope the time will come when the number of periodontists will be greatly multiplied throughout our whole land. The only fear I have in my whole work is from carelessness on the children's part in taking proper care of their teeth during treatment.

I cannot account for the resistance of different mouths! The best result I ever attained was for a boy who kept the filthiest mouth I have ever worked in, and to-day he has not a blemish on a single tooth.

Dr. Howard T. Stewart, New York. Dr. Flint said he hoped to see the day when all orthodontists would be able to have a periodontist in his office to turn over some of the cases to. That may be right from Dr. Flint's point of view. I hope the periodontist may have orthodontists in their offices to turn their regulating over to! It all depends on our point of view. After moving North, somebody introduced me in a dental association as "a man from the extreme South," but in spite of that he hoped "I would become accustomed to the usages and customs of civilization!" I thought of a negro girl that worked for us in the South. Once we brought a servant from the North. She came down there and took absolute possession of the house, and she and the Madame did not agree and she expected to turn this white girl off. The negro wanted to straighten things out! She said, "Don't pay no 'tention to that white girl! She haint been down here long enough to get exactly civilized." I want to say I would feel I would befoul the Southland from which I came if I failed to pay a tribute to the good woman who has read this paper. She is able to take care of herself. There is none in our entire profession more capable of speaking along this line than Dr. Spalding. Several years ago I and several of my men friends tried to form a society of this kind, and we made a failure. Dr. Grace Spalding and Dr. Gillett Hayden—these two women have been chiefly instrumental in founding our society, and I want to pay a tribute to them here.

Dr. Ottolengui. Perhaps it would be interesting if the orthodontists should " 'fess up" and tell how much prophylaxis they are doing.

Dr. Kemple. I should not be surprised if most of us could tell that in very few words.

Dr. Watson. Mr. Chairman, Ladies and Gentlemen: I really did not intend to enter into this discussion to-night, though I promised Dr. Spalding that if our members abused her too much I would come to the rescue! I have known her long enough and well enough, however, to realize that she is perfectly capable of defending any position she may take without any aid from anyone, for it is not characteristic of her to arrive at conclusions prematurely.

Some one has raised a question to-day in regard to the possible danger from highly polishing enamel surfaces. I supposed this point had been settled long ago. I have had an opportunity for a number of years to observe patients who had been under regular monthly treatment, or even more frequently than this at the start, and I have never seen the slightest evidence of anything one could criticize. I have personally been a patient of the essayist for a number of years, and I am sure I have been one of her most disappointing and disagreeable ones, yet I assure you that while the enamel on my teeth is so thin that I have often declared it was sensitive, yet even this very thin enamel has not shown any injury from the polishing. I have also had the opportunity of observing many little patients who have been under regular prophylactic treatment, and it is a pleasure, a real joy, in fact, to have these little tots of four to six years of age come into the office and learn in five minutes' conversation with them that they really know how to take care of their teeth. It is also very gratifying indeed to see the wholesome conditions in the mouths of these children when under orthodontic treatment.

When patients ask about regulating appliances as a possible source of injury to the teeth, I have made it a habit for a good many years to dwell at some length upon the fact that such appliances are a very real source of danger. I tell patients, regardless of whether they are under regular prophylactic care or not, that the responsibility is absolutely their own, and cannot be shifted to another. I will guard against any injury under cemented bands, but in so far as injury may result from contact of the arch with the teeth, especially on the labial surfaces of the lower incisors, the responsibility is theirs, and that the regular daily care is the only way to prevent injury. I even go so far, when I find patients who are especially careless, as to write the mother a note, and if I do not get a satisfactory result from that, I sometimes write the father in much stronger language. I can hardly recommend this practice as a means of promoting friendship, but it is a most effective way of assuring better oral hygiene.

Dr. Kemple. I can say for the members of the American Society of Orthodontists that practically one and all of them recognize the very great importance of the prophylactic work that is being done by the members of the Academy of Prophylaxis, and they also recognize the added danger to young teeth in placing regulating appliances in the mouth, and I do not believe when Dr. Flint spoke of placing a periodontist in his office that he meant it in the way it may have sounded, or as Dr. Stewart accepted it. He meant this was simply an opportunity—the development of this society and the development of this propaganda for prophylaxis—simply offered an opportunity for co-operation between these two bodies of specialists.

Dr. Rogers. Mr. President, Ladies and Gentlemen: I have had quite a varied experience in the subject of prophylaxis. Some have been highly pleasing, while others have been not quite so much so.

It is obvious that some dentists rather neglect this branch of dentistry and are not very particular in placing mouths in ideally healthy conditions. On the other hand, I have been most fortunate as many of my patients have been in the hands of dentists who are really most earnest and conscientious regarding the children's teeth.

I have noticed a tendency in others, as well as myself, of rather shifting the responsibility when once a prophylactic expert has been employed. In one instance I found that the work was not properly done. The lesson we should draw from this is that those who are led to do this kind of work must be most intelligent and conscientious regarding it if for no other reason than that the dentist is apt to relax his efforts.

Dr. Ottolengui. Dr. Rogers comes from the section where the dental hygienist is a bone of contention, and I wonder if that were not a dental hygienist who failed to properly care for his patient?

Dr. Grace R. Spalding. I wish to lay emphasis on the preparation of the tooth surfaces, the polishing of those surfaces which are usually so rough and polishing them according to oral prophylaxis standards, wherever it is feasible (it may not be feasible in a large percentage of your cases at the present time), but the thorough polishing of these surfaces before the appliances are put on would be a great satisfaction to you during the entire course of treatment.

There seems always to be a confusion in the minds of dentists between the oral hygiene propaganda and oral prophylaxis. They are two distinct fields of work, and just as soon as you are able to understand the distinction between these two fields of work you will better appreciate the work we are trying to do.

Dr. Ottolengui spoke of the use of synthetic cement. In the cases I have been treating where synthetic cement was used it was irritating. I have never seen a synthetic cement filling which has a surface which to the sense of touch is a smooth or polished surface, and it does hold bacterial plaques as readily as roughened enamel surfaces.

My idea in suggesting the use of silver nitrate was not after the cavity has actually been started, but where there is the least suspicion of caries developing. By touching such a surface the silver nitrate may protect it.

Dr. Flint, in speaking of this boy who had such an unwholesome condition, and who now has "such a beautiful set of teeth without a blemish on them," reminds me of a statement made by Dr. G. V. Black. He said he never could understand why so often he would find a third molar completely covered with soft deposits and on removing them would find no sign of caries. He said he had decided that a respectable micro-organism would not live in such an environment. That was his only explanation of it.

In every field there are those who are intelligent, conscientious and capable. This is true in orthodontia, in general dental practice, and also in our specialty. Also there are the reverse; unintelligent, unconscientious, incapable. That explains Dr. Rogers' experience in sending patients to those who proved incompetent. I am sure he did not send those patients to a "prophylaxis expert," as he called him.

A Question. What strength of silver nitrate do you use?

Dr. Spalding. A saturated solution.

Dr. Ottolengui. I move the American Society of Orthodontists express their thanks to Dr. Spalding for her kindness in contributing to our program. Seconded and carried unanimously.

The Relation of Mouth Infections to Gastric and Intestinal Disorders.

By Dr. J. M. Rector, Columbus, Ohio., Gastroenterologist, Grant Hospital.

In the study and treatment of diseases of the alimentary canal, a field to which my practice has been limited for the past thirteen years, the relation of mouth infections to gastric and intestinal disorders has become more and more a subject for my close attention and investigation.

That this relation is a very intimate one, that it is one which cannot longer be overlooked in the practice of internal medicine, without serious consequences to physician and patient alike, and that it is one which requires a readjustment of some of our time honored medical ideas, before it may be fully acknowledged, are all my deep convictions.

It is only during the past six years that I have given professional recognition to this highly important bearing of mouth infections upon my cases. By that I mean a recognition sufficient to cause me to make accurate notations of these infections in my charts; to put forth the needed effort to persuade an unknowing, unbelieving, and undesiring patient to a like attitude of mind concerning them, and finally to obtain the consent of this patient to call in the services of a specialist to work in conjunction with myself upon the case.

My records of diagnosis and treatment are in the form of charts of fourteen pages each, on which are noted the following data: the family and personal history; the thorough physical examination of the patient stripped; the observations during the preparation of the patient for the test meal; the examination of the mouth, nose, throat, and sinuses of the head; the microscopical and chemical examination of the stomach contents, the stool, urine, sputum and blood, with blood and pulse pressures; notes on psychological analysis; the number and kinds of treatment given; the progress of the case with accompanying tests, taken at intervals throughout the treatment; and observations and correspondence after dismissal of the case.

In reviewing 683 cases which have come under treatment (this does not include cases where diagnosis only was made) during the past six years, I find from examination of the stool that fully 80% of the cases were in the habit of swallowing practically unchewed food. Sixty-two per cent. of total cases had markedly deficient masticating surfaces. One hundred and thirty cases had mouth infection, a percentage of 18% plus. These one hundred and thirty cases I referred to Dr. Gillette Hayden. In the present article I have selected three case histories for the purpose of emphasizing certain points.

Case Histories
Case I.

Mr. F——————, Columbus, Ohio. Age 35 yrs. Five feet seven inches tall, weight at time of examination, 103 pounds. November 21, 1914. Was a bartender for 12 yrs. now a traveling salesman.

Family History—Negative.

Personal History—Always well until 19 yrs. of age; had luetic infection at this time. Took 3 sss and had no secondary symptoms. Also had gonorrhea. Later his wife miscarried three times. When thirty, began to have disability, stomach and bowel trouble. In past five years would have severe attacks of headache, constipation, spasmodic contractions of the muscles of the back and shoulders and abdominal muscles. All reflexes exaggerated. Would be so sick that he could not lie down for four or five days. Consulted three eye specialists and several physicians and surgeons without relief. He could sleep well when free from the pain in his head. Had been a persistent heavy user of tobacco in every form, including Copenhagen snuff. Had taken much alcoholic liquor and some codein and morphine for his pain. Had difficulty in breathing through his nose for a month previous to examination. Had attacks of pain in the pit of his stomach. The pain was worse when his stomach was full. As he explained it, his stomach "crowded the sore spots." During an attack he constantly sat in a crouched position, could not drink water or take a deep breath. These attacks would come on suddenly and last from one to three weeks, going away gradually; never vomited, pain would be constant, day and night. For a space on the forehead the size of a silver twenty-five cent piece, the outer table of the skull was gone. The inner table was so necrossed that pulsation of the brain could be seen. The nasal tissues were swollen and edematous, the septum perforated, altogether a most distressing picture of general syphilis with syphilic gastritis as a complication.

Teeth—good masticating surface except for damage done by tobacco chewing and general mouth infection involving each tooth. None of the teeth were loose. Anti-syphilitic treatment had to be discontinued because the infected, inflamed tissues of the mouth were irritated to a degree of intolerance, by the mercury and potassium iodid. Referred patient to Dr. Hayden after giving one ampule of 606. As soon as the deposits were removed from the teeth, the inflammation subsided sufficiently to continue the general treatment. Injections of mercury suspended in oil were given twice per week; 606 every ten days until four doses were given. All mouth and nose infections cleared up and all gastric and intestinal symptoms disappeared. Appetite gradually returned and the patient gained rapidly in weight. When I last saw him, one year after treatment, he had gained 46 pounds and was working every day. (His normal weight of 125 pounds was reduced to 103 pounds when he came for treatment). I have been unable to secure another Wassermann test and do not think that he is safe.

This case is cited to show that this man could not accept anti-syphilitic treatment, until his mouth infection was relieved.

Case II. Miss H——————, age 38 yrs., of Clyde, Ohio. Teacher of Domestic Science in High School. Referred by Dr. Hayden, December 18, 1914.

Family History—Negative.

Personal History—Was a frail child; unable to attend school regularly. Had mumps, measles, whooping cough and croup. Had malaria when eleven years of age; was in bed two months and had much bowel trouble. Has had pyorrhea for many years. Some of the teeth loose, showing pockets and some destruction of the gum and bony structure. Has had many bilious attacks with vomiting and headaches. Seven or eight years ago, was "run down and very nervous"; began to have eczema on hands, neck and back, with intermittent recurrence, varying with the condition of the bowel and pyorrhea. Abscess developed in ear two years ago. One year ago an infection followed the trimming of a corn. When moles were removed from neck, each one became infected and healed slowly, because of low resistance. Appetite capricious, eats almost anything. Drinks but three glasses of water in twenty-four hours, no tea or coffee. Can sleep fairly well on right side with knees flexed on abdomen. Takes no exercise except walking. Has no pain, vomiting or acute soreness in abdomen. Little gas in bowel, but marked tendency to constipation with occasional discharge of mucous. Has excited dreams. Occasional painful urination. Is thin and weak; lost seven pounds in the past year. Has been under the care of Dr. Hayden for the past year.

Physical Examination—Five feet three inches tall; weight 102 pounds. Skin dry and yellowish-brown in color. Pulse regular. Respiration shallow. None of the muscles of the trunk or limbs are well developed. Heart negative. Tension over the right side of abdomen. Colon dilated and shows retention of stool. Uterus small and in normal position. Stomach shows normal secretions, nine hour retention of test meal. Much mucous and every indication of infection. Urine scant, one and one-half pints in twenty-four hours. Specific Gravity, 10-25, slight trace of albumen, no casts. Stool shows food remnants, and moderate amount of mucous, no parasites. Blood Picture, red cells, 4,000,000; white cells, 10,200; Hemeglobin, 65; differential count verifies stomach and urine indications of low grade infection.

Miss H————accepted treatment in the hospital, including rest, diet, mechanical treatments for stomach and bowel, massage, olive oil applied to skin for eczema, psychic suggestion and management. There was general improvement in every way, all of the symptoms gradually disappearing. There was increase in weight and improvement in blood picture and patient left the hospital resuming her school work. This patient has reported from time to time for the past year and a half. There has been some recurrence of the eczema but otherwise a gradual disappearance of all symptoms. During the last year's school work there was marked improvement in her condition and an absence of extreme fatigue.

The treatment for the mouth received by this patient in 1913, eliminated all signs of congestion and infection, but the gingival tissues proved to be so low in vitality that very little encouragement was offered for the tightening of eight slightly loose teeth.

There was slight improvement in their firmness during the patient's summer vacation but apparently no further change took place until treatment for the stomach and intestinal tract was undertaken. Since this treatment there has been a steady improvement in color and tone of the investing tissues, and at present the teeth are quite firm and the mouth condition is satisfactory.

This case is cited to show that mouth infection was probably induced by general low resistance, and that the mouth soon became the principal focus of infection, adding directly to the disability of the patient and contributing to the extreme prostration and skin inflammations exhibited. The dental management was not satisfactory until the digestive tube was given an opportunity to supply the energy for repair.

Case III. Mrs. DeV————,33 yrs. of age. September, 1912. Housewife.

Family History—Negative.

Personal History—Headaches and facial neuralgia for the past ten years. Sick at her stomach and vomiting. Loss of appetite and weight, gradually growing worse for the past eight years. Constipated all of her life. Typhoid fever when twenty-two years of age.

Examination shows extensive mouth infection, evidently of many years standing. Several of the teeth were loose and there was considerable destruction of tissue and copious discharge of pus from many deep pockets. The entire alimentary canal was infected with all varieties of bacteria. Skin yellow and cold. Expansion shallow. Exited intermittent heart action. Tenderness over the abdomen. Some swelling of the feet and hands. Stomach showed retention of food for ten hours. Normal acidity. Much mucous and infection. Colon was no-elastic and there was much residual feces.

The treatment for mouth infection was started while the patient was in the hospital, September 23, 1912, and continued until October 24, 1912, or thirty days. At this time the loose teeth had tightened and the infection of the mouth had disappeared. June 5, 1913, the patient returned and received treatment. Her mouth was in good condition and there was no apparant infection. April 4, 1914, the last visit this patient made to the periodontist, the mouth was in only fair condition, the patient's personal care being admittedly lax. At this time my management of the case discontinued. December, 1914, two years after her treatment, this patient began to show symptoms of pelvic infection which developed rapidly until she had a general peritonitis. She consulted a surgeon when this acute condition had subsided and the appendix and all of the pelvic organs were removed. Recovery was slow and unsatisfactory, accompanied by a great general reduction of strength and weight. The patient reports that the mouth became infected again so severely that upon the advice of a dentist she allowed all of her upper teeth to be extracted. This was done without consulting either Dr. Hayden or myself.

In a telephone conversation a few days ago, she reported that some of the teeth in the lower jaw were loose and that she was thinking of having them extracted.

This patient failed to return at the proper intervals for prophylaxis treatment, and also became negligent in the daily care.

This case is cited to show that with infection in other parts of the body, accompanied by lowered resistance, great care should be exercised to maintain the resistance of the tissues of the mouth. There was no evidence of infection of the pelvic organs while this patient was under my observation, and this is no doubt an excellent example of Rosenow's explanation of the activity of the streptococci found in mouth infections.

Sequilla of Infection.

In all work which is concerned with disease conditions of the alimentary canal, infection must form a very large and important part. It is my experience that infections of the stomach and bowel precede interference with motor and drainage functions, giving rise to a condition which fosters the accumulation of the media for culture and growth, and provides an environment conducive to the development of all types of bacteria. These bacteria, according to Dr. Vaughn's investigations, produce a protective ferment. The body cells at the seat of the attack also produce their protective ferment. The struggle for supremacy therefore lies between the two ferments, and the success with which the body can limit the action of the destructive bacterial ferment, depends almost wholly upon the resistance of the patient. If the original focus, let us say a mouth infection, is permitted to continue undisturbed, a handicap is placed upon the body cell, and the invading army of bacteria has all the advantage of a continued and convenient base of supplies. It can travel uninterruptedly to every part of the body through the blood and lymph streams, and along the alimentary canal with the food. All the responsibility for saving the situation is now thrown upon one set of organs, the organs of elimination, and they cannot continue long under the strain. It is an almost foregone conclusion that unless the seat of infection itself is treated in a thorough-going, minutely careful fashion, the invading bacteria will come off victorious.

So determined for conquest are these invaders, that they do not content themselves with entering the body and living on what happens to come their way. They seek until they find the particular environment best suited to their complete development. In fact, as Dr. Rosenow has shown, they seem to search out with a selective power almost incredible, a location so favorable to their fullest activities, that even a harmless, apparently innocently minded little germ is metamorphosed into a fierce and warlike one by this mere change of neighborhood. The bland pneumococcus can thus become the man-eater streptococcus viridans.

A germ may find itself lodged in the environment of its choice, but its chances for a full life may be scant, because the host is a healthy individual. It bides its time until one of the innumerable conditions of human life, a chill, fatigue, exhaustion, comes to break down that wall of resistance of the host, and it enters the breach with zest for the fray.

Cultures from infected gall bladders, gastric and duodenal ulcers, infected appendices, and from other infected areas, when injected into the body of a rabbit or guinea pig, produce, in from 60% to 90% of cases, an identical inflammatory reaction, i. e., cultures from a gastric ulcer in a man, injected into the circulation of a guinea pig, will produce a gastric ulcer in the guinea pig.

That the consequences of throwing this additional burden upon the organs of elimination are not slight, is well brought out in the recent investigation of Dr. Ernest Scott, of the Ohio State University, who has shown that the condition of the kidneys in which sugar and albumen are present, is often the result of overwork of other organs of elimination, and that our old and devout belief that sugar and albumen in the urine are always indications of kidney lesion, will have to suffer a change, these reactions being found to be merely results or symptoms.

It is often my experience that in a chronic, long-standing, stomach and bowel disorder, where there are also indications of organic kidney disease; this latter condition clears up when mouth and other foci of infection are removed, and colonic drainage re-established. These discoveries are of inestimable value, pointing, as they do to the importance of infection in the digestive tube, and acting to prevent mismanagement of cases.

Gastric Disorders.

Gastric disorders may be said to pass through three stages in their development, a first stage of delayed emptying, a second stage of congestion and inflammation with watery or thin serous weeping, and the third stage of congestion and inflammation with heavy serous and mucous discharge. At this point there may be an increased secretion of the acid glands, or thickening of the inflamed mucosa, resulting in temporary achylia, or even dry catarrh. The congestion may extend downward involving the duodenum and the bile duct, and bring on temporary obstruction or catarrhal jaundice. This type of obstruction may be likened to catarrh or coryza, when the nasal passages are completely obstructed for the time being.

Because these conditions are so often mistaken for complete, permanent obstruction, with the result that surgery is considered the only recourse, it seems that there is crying need for a better understanding of the character of infections.

The treatment which I will later outline corresponds to the procedure for relief of nasal cases. Under it the edematous, thickened mucosa about the pyloris subsides, giving free outlet again. If the sources of infection continue, and the patient does not undergo operation during the acute stages, erosion, ulcers, or cancers are likely to be the result.

Let me give you an instance where the recognition of this direct relation of mouth infection to gastric disorders has taken on the aspect of a very serious danger: for while we have awakened, we have done it suddenly and with a jump, and jumps are not good things in our profession.

Mouth Infection and Stomach Ulcers.

The case I mention is where clinical observations have revealed the effect of mouth infections upon ulcers of the stomach and duodenum. It has been observed that if infections of the mouth are not removed before operation for ulcers of the stomach, and duodenum, the ulcers are apt to recur, and that also, the liability to hemorrhage is greater. This is the awakening, and the jump is to the false conclusion that if there is an infected area, the area must be removed, not the infection.

Ruthless Extraction of Teeth Condemned.

If thy tooth offend thee cast it out, is sound reasoning, but first make sure that it is the tooth that offends. All of which advice is simple and homely, but necessary in view of the fact that some of our large clinics have adopted this form of pernicious reasoning, and are removing, nay fairly plucking out in cohorts and battalions, the teeth that have been attacked by bacterial activity, and are in dire need of the bread of first aid to the injured, and instead are given the stone of complete knock-out, and that too by their own generals.

Even in that particular bright star among clinics, the Mayo Clinic, this method is pursued, or was pursued no later than last winter when I had the opportunity of observing it.

As an organization why do you not see that these clinics are informed? Give them the benefit of your knowledge, let them know that you are alive to this need; suggest conferences with their staffs, and determine to wipe out these last vestiges of the dark era. As a group your power is unlimited, because you have come into existence with a torch of light for the future in your hand. You are met together on some fundamentals which no intelligence, once seeing, can deny, and which must finally be known and accepted by all, as fundamentals.

Teach the people these simple truths, and that means teach the press. I believe that the press is eager for accurate information, provided you give it to them chewed just enough for the processes of digestion to be well started. I need say no more in the presence of past masters of this art.

Then there are the colleges which need somewhat more by way of persuasion, something akin to prodding. Educational institutions are like elephants, highly intelligent, but those who know them best use a hook to get them started.

And last there is the medical profession, practically virgin territory not yet open to dental settlers. You will doubtless succeed here on your record of past contributions to medical advancement, a record which ought to be an open sesame wherever you go. Joint meetings, conferences and inter-committee reporting of related programs, would all help.

Then in a glowing, and I believe not distant future, the present arbitrary division, making separate professions of dentistry and medicine, will disappear, and dentistry will take its rightful place as an acknowledged part of a great whole. A profession whose own structure is an idealism of the entire human race, can do no less than make itself complete. Then will the vision of a hundred years ago, of Horace Hayden be fulfilled.

In conclusion let me say that I like you, I am enthusiastic about you, and I wish you God-speed.

Discussion of Dr. Rector's Paper.

Dr. Gillette Hayden
Columbus, Ohio.

It is with a deep sense of appreciation of the encouragement which the American Society of Orthodontists has extended to us that we are here this evening, for I feel your encouragement and help is a thing which we should value and which we need. You probably remember the time when you were a youthful organization, receiving the criticism and lack of understanding on the part of your fellow practitioners in dentistry. We are experiencing, and have been experiencing the same difficulty, and we hope in the near future to be able to arrive at the point at which you have arrived, that of a distinct organization with a distinct field wherein you are accomplishing successful results and where there is no opportunity for anyone in the dental profession or outside of it, to question the value of your work.

The American Academy of Oral Prophylaxis and Periodontology has the honor to present a paper on the "*Relation of Mouth Infections to Gastric and Intestinal Disorders,* by Dr. J. M. Rector, of Columbus, Ohio. He has been devoting his entire time to diagnosis, and to the treatment of intestinal and stomach disorders. That which I think should be interesting to us in this paper is the fact that we as dentists, orthodontists and periodontists are dealing with the first part of the digestive tract—the only part over which each individual has a direct control, and Dr. Rector's paper will call your attention to the remainder of the digestive tract and show some of the interesting phases of the lack of use of the first part of the digestive apparatus.

(Dr. Rector's paper appears in this issue.)

Dr. L. Litchfield, M. D.
Pittsburgh, Pa.

Mr. Chairman and Members of the Society: It always gives me great pleasure to be invited to meet a body of dentists. I feel as Dr. Rector does, and as Professor Thayer of Johns Hopkins strongly put it last winter—that dentistry should be a part of medicine: the dentist should be a medical specialist. It is just as important to treat a toothache as to treat an earache, and it is absurd that a man must have a medical degree to treat eczema or straighten a saddle nose, and should not need a medical degree to treat pyorrhea with its widespread effects, or to straighten the jaws and render possible efficient mastication and insalivation.

Several years ago when making up a program for our State Medical Society, I introduced papers by prominent dentists of this State, and this custom has been followed in subsequent meetings. In the last meeting of our National Association several dentists were on the program. I think the day is not far distant when the dentists will have a Section at the meeting of the American Medical Association, and the next stage will be that dentists will all be M.D.'s and a great deal of the mechanical work will be done by trained assistants who do not need to be dentists.

Several years ago I began noting on case histories whether or not patients had pyorrhea. I often think how you dentists must smile when you see a doctor examining the patient's stomach with X-ray, pumping out the stomach, removing the tonsils, curretting the naso-pharynx, making X-ray pictures of the skull, etc., to find out why the patient has a bad breath, and never thinking to look at the gums and teeth. You must often laugh in your sleeve at the poor doctor who overlooks the things right under his nose and goes to such trouble to locate the responsibility more remotely.

Relation Between Pyorrhea and Gastric Disorders.

Several years ago I was struck by the fact that nearly all my gastric cases had pyorrhea, and in order to approach the question from the other side I thought it would be interesting to know how many of your pyorrhea cases had gastric symptoms, particularly symptoms of hyperchlorhydria or ulcer. I therefore had some blank forms printed and distributed to such dentists in different parts of the country as I thought would be interested in this investigation. These forms contained a certain number of questions which were to be put to your patients, either by the dentist or his secretary, one sheet for each patient. I got about 100 answers and some of these may be of interest to you.

In answer to the question, "Have you ever had any trouble with your digestion?"—a question I tried to put very generally, to be understood by the dentists and patients also—59 out of 100 answered "yes." And then the question I was particularly anxious to get at—"Which was noticed first, the gastric symptoms or the mouth symptoms?" Of course, that does not carry us very far, as people often have much mouth infection and do not notice it, and therefore, the answer that they noticed the systemic symptoms first does not necessarily mean that the gastric symptoms really preceded the infection of the mouth. In the answers received the mouth infection was noted first in thirty-five and the systemic symptom first in twenty-seven. That is about 33% more confessed that they noticed the symptoms in the mouth before the disturbances of the digestion. Thirty-eight of the hundred had more or less heartburn and symptoms of hyperacidity. Fifteen complained of nausea and vomiting, and two or three had vomited blood or passed blood in the stools. About twenty gave symptoms which referred rather strongly to ulcer of the duodenum just below the stomach. The other questions related to tonsilitis, appendicitis, rheumatism, cardiac infections—all of which I believe have a direct relation to mouth infection, but which are not pertinent to the present discussion. In considering the relation between mouth infection and gastric disorders, the vital question is, "Which comes first? Does the patient have mouth infection and develop pyorrhea, etc., because the resistance is pulled down by gastric infection or digestive disturbances, or, do they get the digestive disturbances because the infection spreads from the mouth?" This question is as yet entirely unsettled, and it requires that someone with patience and devotion shall take it up systematically and conscientiously.

Rosenow's Theories Disputed.

Although I find Rosenow's work fascinating to read, and I like to hear him talk, yet I do not agree with Dr. Rector that his theories have been established. I feel they have never been established. You cannot convert a pneumococcus into a streptococcus, etc., nor can you convert one group into another. In the Rockefeller Institute of New York City during the past three years they have cultivated and followed more than one hundred strains of pneumococcus, and each strain still breeds true and distinct from every other strain, and responds to the bacteriological and immunological tests as definitely now as it did three years ago. I think it is a rather vital question, because if a spirochete of the mouth can change into a spirochete pallida it might infect a person with syphilis. But I do not believe in the mutation of bacteria, and I think that is a point that makes it all the more important to clean the mouth up and keep it clean.

In relation to this matter, in cases of pneumonia at the Rockefeller Institute, the pneumococci in the mouth correspond to the strain found in the lung, by study of the sputum, by blood cultures, or by puncture of the lungs. The only cases of pneumonia apparently which developed from pneumococci which are in the mouths of healthy patients, belong to Group IV and are usually mild. The more malignant forms of pneumococcus are not found in the mouths of healthy people unless convalescent from pneumonia of that type, or unless they have been exposed to such a case.

So far as the adult is concerned, we do not know whether the stomach trouble comes from the mouth infection or the mouth infection comes from the gastric or digestive disorders. Possibly it is sometimes one way and sometimes the other. When it comes to treatment we do know it is vitally important to get the mouth cleaned up, and it is the hardest thing to get patients to do that. Patients come back and say, "I have done just as you told me. I have taken the medicine and followed the diet you prescribed, and I am not any better." I say, "Have you had your mouth cleaned? Have you gone to the dentist, etc.?" They either say they went to the family dentist and he said the mouth was all right and Dr. Litchfield does not know anything about the mouth—he should fix up the stomach and the mouth would be O. K.—or they do not go to the dentist at all. I tell them that I will not treat the case, or start it, until they have had the mouth put in a sanitary condition.

I thank you very much.

Dr. A. C. Barclay
Pittsburgh, Pa.

When we were children we asked our parents and others the question that our children are asking us to-day, namely, "Who made God?" This question has no answer.

Another question that has been asked for a million years or more, is being asked to-day by a clamorous multitude, namely, "What causes disease?" This is unanswered yet, but the future is bright with hope.

The universal cause of disease will be announced some of these days. You are saying "it is known now, anybody knows bacteria causes all diseases," but are you sure of that? Bacteria are omnipresent and wait only upon a coalition of the elements necessary for virulent activity.

I do not believe that bacteria can or do invade living, normally healthy tissue. There must be some lowering of resistance, some irritation that makes the tissue susceptible and what that condition is will be *the next great step,* or discovery, in the cause of humanity, and contrary to Dr. Mayo, *it is up to the medical men* to take that step.

If they do not, then the dental profession will do it for them. Personally I believe it will be found resulting from, physical and mental habits, and diet, incidentally two important items not listed on Dr. Rector's examination charts.

The dental profession is taking the next great step as indicated by Dr. Mayo. We are doing better root canal surgery and better prophylactic work. All hopeless teeth are being extracted and focal infections are being cleaned out, and that will go a long way towards health, if the medical crowd will get busy and give the investing tissues, of the field of dentistry, a stream of pure blood, to nourish them and thus maintain their power of resistance.

If the dental profession were going to tell the medical men what to do, they would tell them to watch the character of fuel that enters the furnace and see that it is not chocked up with soot and ashes. You must treat a furnace right or it will smoke you out.

If our medical brethern will teach humanity how to prevent enervation, auto-intoxication and auto-toxemia, pyorrhea and "focal infections" will die a natural death.

This band of specialists can become agriculturists and the general practitioners will be their managers and form bands. And Ponce De Leon's dream will be a reality.

"Auto-toxemia" means, "poisoning by one's own waste products, brought about by inefficient elimination; and faulty elimination is caused by enervation, a weakened state of the body; lost resistance." We might go on and say that enervation is caused by over-indulgence of any kind, or anything that uses up two much nerve force.

There is little chance for argument, when the statement is made quoting what Rosenow has found to be true: I allude to the selective action shown by bacteria when injected into rabbits and guinea pigs by affecting the same tissues and producing the same pathologic condition as produced in their former home.

But all mouth infections do not produce secondary infections; in fact only a small per cent. do, and it may be that ofttimes the mouth is the secondary infection. However, the danger is great and must be guarded against by eliminating every focus.

Dr. Puterbough of Chicago says "In oral suppuration of the mucous membrances we will, if observant, find in practically all cases, some underlying toxemia, acting in a manner that tends to lower the tissue resistance. These general irritants that lower resistance, may be divided into three groups.

First—Those resulting from bacterial fermentation in the intestinal tract.

Second—Errors in metabolism, lack of proper function, making poisons out of food material that can't be used.

Third—That large group of auto-intoxications, resulting from faulty elimination of waste products.

Again Dr. John B. West of Elmira, N. Y., says that after years of investigation he has concluded that in the vast majority of cases we have mouth infections complicated with other systemic conditions, notably auto-intoxication, acidosis, anemia, and faulty elimination.

Dr. Hopewell-Smith says that he no longer teaches that pyorrhea is a disease, but that it is a symptom of disease.

The question then is how much can we blame the mouth for these things that are occurring in other parts of the body? To what extent are the mouth infections primary? No one can tell us that.

Eliminate all systemic factors, then who can say that a single tooth would abscess, or who can show us the case that would surely have been pyorrhea? It does not seem fair to blame the teeth so much, when there are so many contributory factors.

It is safe to predict, that when sanity shall have assumed control again, "focal infections" will be placed on the shelf along side of the tonsils, appendices, and ovaries.

Dr. Gillette Hayden.

One particular thing in connection with the work in these cases which have been referred to me by Dr. Rector is this: I tabulated 89 cases of the 130 and found that 34 had what we term gingivitis. Forty-four had macroscopic pus forming about one to five teeth. Eleven had a general pus infection of all teeth.

All periodontists find in the handling of their cases that there are numerous complaints of digestive disturbances. Many of these clear up, and the patients will tell you continually, upon inquiry, that they feel no inconvenience in the way of indigestion such as they had felt before: but I am continually noticing that those who are suffering from intestinal stasis never report that they get more than temporary or periodic relief from the treatment of the mouth. These are suggestions from a few findings I have been attempting to tabulate for a short space of time, which indicate a large field waiting for investigation.

Dr. E. A. Bogue
New York.

Forty-eight hours ago a gentleman sat in my chair and said, "Shall I not go to the gentleman calling himself (he did not use your term periodontist) a practitioner of prophylaxis?" I said, "Yes, if you have fifty or sixty dollars to spare, you might as well go to him." "What! Have I pyorrhea?" "You have not now." "Have I all my teeth?" "You have thirty-two." "Did I have pyorrhea three days ago?" "I thought you did, but on carefully polishing all the teeth I found you have not." "But I was told by this practitioner I needed to go for at least eight hours to have prophylaxis work done. What does that mean?" "I do not know." The gentleman has not to-day a single unfilled cavity. His teeth are beautifully in order, but his condition is such that I said to him, "No matter how skillful, how honest, how earnest the man may be to whom you go for prophylactic work, you never will be free from pyorrhea unless you do the work of cleansing teeth and massaging gums yourself and probably these ladies will show you how to use your brush and fail to use your brush, and then you will no more need their assistance than the old cow needs a tooth brush or a horse requires the farmer to cut his hay up fine."

Dr. R. C. Stewart
New York.

I cannot let this occasion go by without speaking of the fact that the main point that I think the essayist meant to bring out has scarcely been touched upon, and that is, if I am right, the importance in certain conditions, of the medical and dental profession of cooperating together. The longer I practice the more important I believe this to be. It has been exceedingly hard to get the medical and dental profession to cooperate together. Neither understands the other. Neither has seemed to want to understand the other up to the present time. Both are just beginning to come together, you might say, and in our work, especially as periodontists, I believe that we more than any other branch of dentistry, are going to be the means of bringing about this cooperation.

I had a person under my care, a young man about thirty years of age. He had no suspicion that anything was wrong with him, but he was sent me by his dentist for treatment for Riggs disease. He had a profuse flow of pus. We treated it locally and got the pus stopped. It is no great trouble to stop the flow of pus, usually. It is astonishing how quickly you can get control of and keep control of conditions in the mouth by local treatment. I said to him, after stopping the pus, "Doctor I want you to have a physical examination. Have you had one?" He said "What do I want with a physical examination!" He said he was an athlete, and robust and there is not a stronger man in New York today. I said, that may be true, but there is something back of this and I want to find out what it is. He had an examination made then and the physician reported to me he had Bright's disease.

A few months ago a young woman about thirty years of age came to me, nervous, high strung, intelligent, and there was nothing especially the matter that I could see, and after she had been under my treatment for some weeks I was much puzzled to know what was the matter with her, and noticed one day a very slight projection of the eyes, as I thought, but had never noticed it before. I examined the throat and noticed a slight swelling of the throat, and you know what that leads to. I sent her to a surgeon who diagnosed goiter. She had had this trouble some years and did not know it.

I simply quote these cases to show the importance of what Dr. Rector meant to bring out. In a conversation with him today he said to me, "there is an immense amount of missionary work to be done. The medical profession does not understand what you can do and you do not understand what we can do. We are not cooperating." That is true, and when the periodontist will learn to look for these symptoms and anticipate them, then I think when we learn to cooperate with all the different specialists in medicine, there will be hope for the future of our work.

Dr. Rector. I thank you for the discussion of the paper. Many points which have been brought out, are more interesting than the paper itself. I must agree with Dr. Litchfield. I am sorry he has left the room. I see many cases where the consulting physician examines only the extended tongue, and he sends pills and powders through the foul mouth, which was only showing symptoms of the condition. How that can be done by a man interested in his case,—how he can look at the tongue and miss pyorrhea and other mouth infections, I do not understand.

The one thing I hoped to do in coming here, was to try to reach a closer cooperation between physicians and dentists. We need it and the people need it, and it must come if we are to handle these complicated conditions successfully.

Now there is some question here by Dr. Litchfield about the trustworthiness of Rosenow's work. I do not think he is exactly fair. Rosenow is almost above suspicion,—has occupied posts in different colleges, and is now in the Mayo Clinic, is probably the highest paid investigator in this country, and he has contributed many useful and almost astonishing things, and if his latest contribution has not been proven I do not think that should condemn all his work. At least we should give a man of his reputation the benefit of the doubt until somebody else learns how to verify his work. I have not done any work to verify his views, but I think I can take his word for it. I saw some of his work last winter.

Report of Clinic

By Oliver Wilson White, Detroit, Mich.

Realizing that the correction of malocclusion is not always accompanied by the restoration of lip function, and nasal breathing, I adopted the following method of treatment which consists of a lip bandage worn by the patient during sleeping hours.

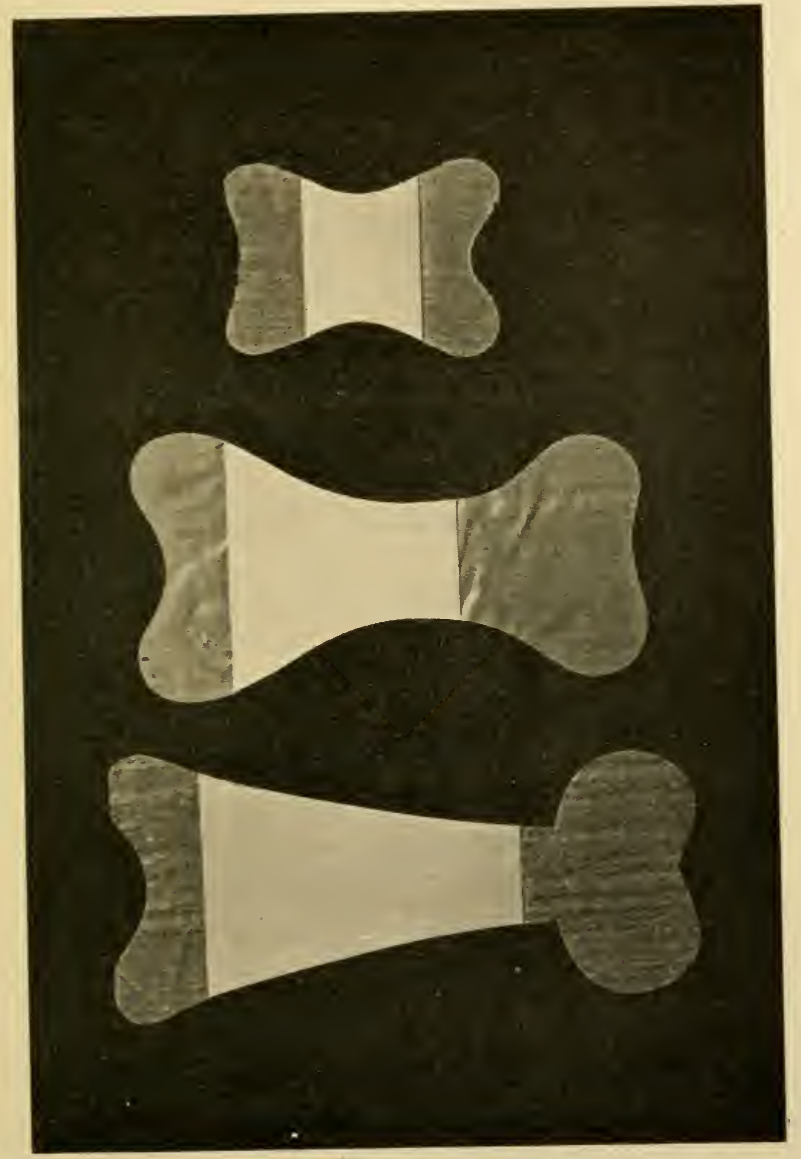
As shown by the illustration, bandages are formed in such a manner, that when properly placed in position mechanical lip pressure is restored, and the mouth is held closed, thus nasal breathing is forced without sealing the lips, yet the bandages permit patient to cough, sneeze, or speak without removal.

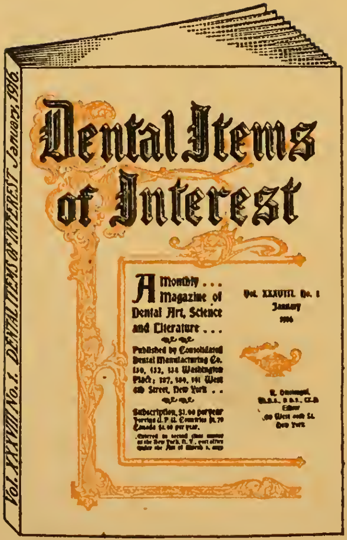
Bandages are manufactured for me with the adhesive portion made of three different materials. Silk, cambric, and adhesive surgeon's material, with three sizes for each material,-2-3-4.

Satisfactory results can only be obtained by their prolonged use, as patient reverts to the habit of relaxation of lower jaw and mouth breathing, following a cold or nasal infection so easily that I have patients continue their use as long as possible.

Not only local but general systemic improvement will be observed very quickly, in a large number of cases which is indeed very gratifying to the orthodontist.

In prescribing these bandages care should be exercised to make sure nasal passages of patients are free of obstruction.





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17

SIXTEENTH ANNUAL MEETING

HELD AT
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NINETEEN HUNDRED AND SEVENTEEN

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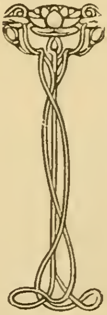

SIXTEENTH ANNUAL MEETING
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EXCELSIOR SPRINGS, MO., Sept. 5-8
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Dates and Places of Meetings.

First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30 and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

Tenth Annual Meeting held at Denver, Colo., July 13, 14 and 15, 1910.

Eleventh Annual Meeting held at Boston, Mass., September 20, 21, 22, 23, 1911.

Twelfth Annual Meeting held at Chicago, Ill., July 1, 2 and 3, 1912.

Thirteenth Annual Meeting held at Chicago, Ill., June 30, July 1, 2, 1913.

Fourteenth Annual Meeting held at Toronto, Canada, July 2 and 3, 1914.

The regular 1915 meeting was abandoned in order not to interfere with the section on Orthodontia of the Panama-Pacific Dental Congress, held in San Francisco, Cal., August and September, 1915.

Fifteenth Annual Meeting held at Pittsburgh, Pa., July 20, 21 and 22, 1916.

Sixteenth Annual Meeting held at Excelsior Springs, Mo., September 5, 6, 7 and 8, 1917.

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The American Society of Orthodontists.

President's Address.

Dr. M. N. Federspiel, Milwaukee, Wisconsin

Permit me at this time to express to you, the members of the American Society of Orthodontists, my deep appreciation of the high honor that you have conferred upon me in selecting me to preside over your deliberations. I would be happy indeed, but for the sense of unworthiness on my part to fill so high a position. I shall always esteem the presidency of our society, composed, as it is, of the leaders of orthodontic science and art in this and other countries, one of the highest honors conferred on me.

Carlyle has said: "The profession of the human healer is radically a sacred one, and connected with the higher priesthood; or rather, is itself the outcome and acme of all priesthoods, and divinest conquest of the human intellect here below—as will appear one day."

It is self-evident that the wisdom possessed of the art in treating human ailments, is the measure of the refinement and civilization to which the people have attained. Science in its broadest sense is synonymous with learning and knowledge. In early times when the knowledge of Nature was small it was not necessary to divide science into parts, and men of science did not attempt to specialize.

As the scope of knowledge and wisdom increased it was impossible for any one man to be familiar with all scientific subjects, so that there began a tendency towards division and classification for a better understanding of certain subjects.

Reprint from Dental Items of Interest

The accumulated experiences of one department of science, and the special methods which have been developed to such a high standard to deal with its problems, become necessary in another department.

Geology uses the methods and data of physics, chemistry and biology; sociology needs biology, yet some group it with economics; the practice of medicine is nothing more than applied biology which uses the methods and data of chemistry.

The high development of the different channels in the different sciences will ultimately bring about a better understanding that after all science is in reality one; yet we may approach it along various paths; we may view it now from one side and now from another.

The history of the healing art is as old as the history of the human race. Unfortunately the past has not preserved the name nor any monument of the benefactor who first ventured upon the attempt to relieve the maladies of his fellow beings. To know this would be equivalent to knowing the origin of civilization.

What is regarded as learning, erudition, or wisdom, is a treasure which others have won and possessed before us. It is the promise of intelligence, to investigate causes and origin, to become free from the narrow limits between the cradle and the grave. We become broader, wiser, purer and better for having learned of what has been. It strengthens our faith and ambition in regard to the future; we become liberalized, refined and ennobled. By such eating of the tree of knowledge, the eyes become open, and the man is as a god. He makes the divinest conquest of the human intellect.

Orthodontia must be considered as a specialty and to understand it one must be grounded in the fundamentals of science. Unless one understands and appreciates the principles concerned in the handling of tissues; the causes and result of inflammation; the principles of mechanical engineering; the pathology of conditions that bring about malposition of the teeth and dento-facial deformities; how to prognose as well as to diagnose and many, many other important factors, he cannot have a complete understanding and properly manage orthodontic problems of everyday occurrence.

Patented Cure-All Appliances Condemned.

Orthodontia is far too serious a matter to be lightly undertaken by those who are not thoroughly trained in the fundamental principles underlying its proper performance. Yet it is of common occurrence for dentists to attempt the handling of orthodontic cases, who through flattering advertisements, by trade houses and mechanical laboratories, are led to believe that the correction of malocclusion and dento-facial deformities are free from perplexities upon the purchasing of certain appliances that are constructed, patented, and endorsed by some famous orthodontic wizard. I do not know of anything that is more vicious than this so-called patented cure-all appliance to undermine the progress of scientific orthodontia and degenerate it with a trade or sleight-of-hand performance.

Post-Graduate Teaching.

There is no such thing as orthodontia made easy; there is no trick about it that can be learned in a few weeks' course by making beautiful models and free hand soldering, by watching the manual dexterity of some clever operator and admiring models and photos before and after treatment.

It is so easy for young dentists to be led by such false gods into believing that a specialist can be manufactured by adopting a system and its appliance. It looks so easy, and it seems so simple. Right here I am reminded of the time when I was young and just out of a dental school. I had completed a few weeks' course in orthodontia, returning home with a diploma as a distinction of high training. I had the good fortune to meet a beloved teacher and friend, a man of wide experience and excellent judgment and possessed with a vision of broadness in its scope; not only highly trained in dentistry but a wonderful physician and surgeon, the late Dr. B. G. Maercklein.

When I informed him of my intention to specialize in orthodontia he remarked, "My boy, remember that any ordinary orthodontist can move teeth; it takes years of study, experience and observation to hold the teeth in their new positions." It is well therefore, for a dentist before he poses as an orthodontist to weigh well the responsibilities that are involved. The inexperienced operator, owing to lack of proper training and insufficient experience is usually at fault in working out a clear diagnosis and prognosis. He attempts to do something that he is not competent to do. He places himself in a false position before his profession and before the community.

Such a man reminds me of the young medical graduate, who through procrastination and having a rich father to rely on, was not making much of a success as a medical practitioner; so he decided that a trip to Europe would fit him as a specialist. When he arrived at the *Allgemeines Krankenhause,* and was told that in order to be a specialist he had to knuckle down to hard, strenuous work, he was satisfied to let the other fellow use the microscope, while he enjoyed a student's visit at the beer table. After six weeks' sightseeing in Vienna, Berlin and London he returned to his home town and introduced himself to the profession as a specialist with the following words: "I have just returned from over the sea, send your cases straight to me, I am a specialist, yes, by gee, and I belong to the State Societee."

I have observed, in my time, that quite a number of dentists, who have always been flat failures in the practice of their profession, spend a few weeks in some post-graduate school and then pose as specialists in some branch of dentistry. This sometimes makes me wonder. If the specialists are to draw their recruits from the failures in the mother profession, then we cannot hope to look forward to higher achievements in the various specialties. The advancement in orthodontia depends entirely on the type of men that are enrolled in this field; therefore, it is necessary that the dental profession should encourage the rule that every dentist before entering a dental school should be possessed of a broad and liberal education so that he may understand and comprehend the interrelated sciences.

Quackery.

Travel as I may through this entire country, visiting dental offices, I am more than surprised to find that provision for the material comfort of the patient is very much in evidence, while scientific equipment is hopelessly scarce. The most powerful weapon against quackery of all sorts is a well-equipped laboratory attached to the office of a dentist. The laboratory with a work-bench, vulcanizer and casting machine must be enlarged to include a complete armamentarium to conduct proper investigations along bacteriological and pathological lines. While this may seem to add considerable more work it makes the practice of dentistry of absorbing interest when one feels that he is approaching the study of a case equipped with modern methods. It is lack of accessories and inability to use them that makes so many men diagnostic misfits and careless in their treatment.

It is our duty, yours and mine, to see that dental education is limited to those institutions that can and do give proper opportunities to their faculties and students. We should see to it that public sentiment is aroused in support of this necessary advance. As long as the profession of dentistry, including its various specialists, tolerates our present day methods of dental education, and manufactures technicians, instead of true scientists, quackery will predominate in its various forms.

The highly trained stomatologist does not have to yield to quack methods, nor does he become enthusiastic over the "cure-all" remedies that are so widely advertised in our trade journals and periodicals. Let me illustrate to you what happens to men who are not trained along scientific lines. Most of you will recall how so many physicians and dentists over this entire country became hysterical over the guaranteed pyorrhea cure called emetin. Drug houses, anxious to reap a harvest while the reaping was good, sent out armies of drummers in the garb of pseudo-scientists to teach the poor dentist to fight the amœba bucallis and thus establish a pyorrhea cure. Trade dental journals were filled with advertisements of reports of cures; newspapers and weekly periodicals told of this wonderful miracle. Thousands of patients were given emetin injections by dentists and physicians; the whole country became emetin-mad. This all happened long before research laboratories could tell of the merits or demerits of emetin.

Radiography. Almost simultaneously with this emetin delusion another fad developed, better known as the "tooth pulling rheumatic cure." Unfortunately many patients had teeth extracted that could have been saved through scientific dentistry. The reason for the extraction of these teeth was that the dentist was led to believe, that the presence of certain dark areas in a dental film was sufficient grounds to warrant immediate extraction, thereby removing the primary cause of the systemic condition. This brings me to the interpretation of dental radiographs. Strange as it may seem, the X-ray has been and is much abused. The Röentgen ray was never intended to reveal the exact pathological findings at root ends. The best that it can do is to aid us in our various tests to draw our conclusions. No man has a right to base his treatment on the reading of an X-ray picture, without taking into consideration the various tissue changes that may take place. When men have a true understanding of the tissue changes that take place in acute and chronic inflammation and are familiar with the histo-pathology of morbid conditions involving root ends, then and then only can they realize that the dark areas involving root ends in a radiograph does not always mean a root abscess, or a blind abscess; that the dark area may be nothing more than less density of bone; or an epithelial root tumor; or a root cyst; an innocent granuloma; a suppurative granuloma; an apical ostitis; ostitis fibrosis cystica; a rarifying apical ostitis; a root end necrosis; a root end cementoma; or a proliferative pericementitis. Unless a man has an understanding of these various pathological manifestations he has no moral right to interpret radiographs.

If dentists could have had a more liberal and broader education in the interrelated sciences they would have then been in a position to point out to the advocates of this hysterical fad that it requires more than an X-ray film to make a differential diagnosis.

Misleading Orthodontic Fads.

In our own specialty we have our fads. Our journals are filled with advertisements in which mechanical laboratories advertise their wonderful method of fitting appliances to models, by their orthodontic experts who are able to make a diagnosis and prognosis by the mere study of a crude model. I almost shudder when I think of the remarkable increase in the so-called "mail-order orthodontic treatments" that is being carried on among dental laboratories. Then there is another fad that seems to have swept over this entire country, known as "the radical expansion of the super-maxillary bone in order to separate the palatine suture," thus giving more breathing space in the nasal channels for the patient who was supposed to be a mouth breather. Rhinologists and dentists who had no understanding or training of the forces of occlusion became enthusiastic and laboratories were busy fitting jack screws to models. Arches were widened regardless of whether the occlusion was normal or not. I know of one case where a so-called specialist went so far as to expand a normal arch for the purpose of trying to cure a case of oto-sclerosis.

It is ignorance, or lack of training, or to be spectacular, or a madness to extract American dollars that have tempted young men to ignore the fundamental principles of modern therapy and surgery. Is it not high time that we clear the atmosphere of the things that are obnoxious to science and devote more time in our literature and meeting places to studies that will develop the practitioner skilfully so that he may give his patients the benefit of all the accessories which are so important in the recognition and successful treatment of disease? Therefore, I would recommend for your consideration that if we are to develop along progressive ideas we must encourage enthusiasm based on scientific investigation.

Treatment of Mutilated Arches.

Some time ago our society had the pleasure of listening to a splendid paper which was read by Dr. Lourie, entitled "Compromise Treatments." It seems to me, that when we review the literature in orthodontics during the last fifteen years very little has been published upon mutilated cases and extreme malformations where it was impossible to obtain a complete restoration of the forces of occlusion. Strange as it may seem, the average orthodontist has not been doing his duty to encourage the treatment of this class of work. While it is fitting and proper to encourage the treating of malocclusion during the period of tooth eruption we should, as specialists, be in a position to be ready at all times to diagnose, prognose and treat these extremely complex cases, which have not had an opportunity to be benefitted in childhood. We should endeavor to encourage the investigation and handling of these extreme malformations.

Orthodontic Records.

At the last meeting of our society, held at Pittsburgh, Dr. F. C. Kemple, in his presidential address, called your attention to the need of standardizing our clinical records in the following words: "One of the weak points in the fabric of orthodontia to-day is the scarcity and incompleteness of our records of both treated and untreated cases. I am more than pleased to have on the program of this meeting a paper by one of our veteran members on the subject, '*The Records of an Orthodontist.*' To my mind, this is one of the most important subjects with which we have to deal, because of the fact that in the final analysis these records must form the very foundation of our knowledge of malocclusion."

Most of you will recall that splendid paper entitled: *"The Records of an Orthodontist,"* read by Dr. B. E. Lischer, which was published in the 1917, March issue of the DENTAL ITEMS OF INTEREST. Following the doctor's address the Forsyth Dental Infirmary requested the appointment of a committee to suggest a standard system of record cards, so that the enormous amount of material at the Infirmary may be standardized, classified and made available for the profession. I sincerely hope that at this time the committee will be in a position to present, in concrete form, a report on this matter.

It is unfortunate that our society has failed to standardize our clinical records. If every member in this society would have carefully recorded his cases, during his orthodontic practice, we would then be in a better position to draw our conclusions in the diagnosing, prognosing, and treating of cases.

Revising of Constitution.

I wish to call your attention to the need of revising our constitution. At the last meeting a committee of three members was appointed to suggest corrections and revision of the constitution and to report to the society at this meeting. I sincerely hope that the committee will make its report and that the matter will be given a free discussion on the floor.

Terminology.

While orthodontia has made remarkable progress and the literature is becoming voluminous our terminology is being sadly neglected. If the American Society of Orthodontists is to be the representative society in orthodontia, then it should have enough pep and initiative in itself to go on building its own roads and bridges; to tell the world that we are on the map and that we are helping to write history in the pages of American dentistry. One of the most important matters to be settled is a correct terminology. It is pathetic and pitiful to be associated among friends, who are supposed to understand the science of orthodontia, who cannot write or talk intelligently on the pathology or oral deformities.

This, no doubt, is largely due to orthodontic provincialism. As long as we remain slumbering and unawakened and are willing to follow in the footprints of the egoist we cannot hope for scientific progress. Therefore, we should discourage within our membership the imitator who is willing to let well enough alone, who makes no advancement, but remains a parasite on the society. Right here I wish to quote the following from an editorial in the *International Journal of Orthodontia, on "The Imitator"*: "The imitator is a vulture of human achievement. It is the dead hand that would paralyze initiative, stifle effort, and dry up the spring of hope and courage. It would perch in its sombre garb over the cradle of new thoughts, new ideas, and great ambition. It would strangle in its icy grasp the great dreams of human progress, it would drape its banner of defeat over the forces of civilization and would turn back in their course the stars of human grandeur." The future development of orthodontia, the standing we hold in the community where we practice, rests entirely with us. I do not know of any way of uniting the society on a more solid foundation than by creating a spirit of enthusiasm in each and every member to strongly endorse the American Society of Orthodontists. This Society may rightly be considered a clearing house, a means to an end, a post-graduate school, a representative society of progressive orthodontists, but there is much to be accomplished; like the battle of life, it means to struggle on; to blaze away; to learn to exchange ideas; to be familiar with orthodontia as it is practiced in this and other countries; to learn to give our patients all that orthodontia offers; to help the weak; to encourage the strong; to do this and more we must sacrifice ourselves to the task of laboring among our fellow practitioners in order to raise orthodontia to the high standard of which it is deserving.

The American Society of Orthodontists should be democratic and charitable; its doors should be open to all men who are willing to conduct themselves along professional lines. Political and star chamber sessions should be discouraged; men elected as officers should realize that they owe a duty to the fellow member in guiding the future of the society, to engender fraternalism, to help the weak and encourage the strong.

Discussion on the President's Address.

Dr. C. A. Hawley, Washington, D. C. I have only had an opportunity to glance at the paper a few minutes before the meeting, so that it will be impossible for me to present an extended discussion.

With the main tenor of the paper I am in hearty accord. The ideals on education are well worthy of the writer of this address. His statement of the dangers to which the science of orthodontia is subjected from imitators and from men poorly prepared is not overestimated, but, it seems to me, as a protection in our profession, as in other professions, we have the honest, honorable and thorough work of the best men, and the protection of the people lies in the conscientious work of men in our society as well as other orthodontists throughout the United States. It seems unfortunate that we have no established school to prepare our men as they should be for this work. It is unfortunate that Dr. Angle could not have continued his school and thus have helped to carry out his high ideals in orthodontia which he established. We know that a man cannot equip himself as an orthodontist in the true sense of the word after eight weeks or a few months of instruction. We should have a post-graduate school with a year's course and with a continuous clinic, where cases could be observed from the beginning to their finality. Only in this way could we have adequate preparation for the practice of orthodontia. Unfortunately that does not obtain at the present time. I think if this society could exert any influence in establishing such a course, it would be a great advantage.

Regarding another topic discussed in the address, namely, the revision of the Constitution and By-Laws, I am in hearty accord with what our President has said, and I think it would be well to appoint a committee to revise the Constitution and By-Laws and bring them up-to-date.

Dr. B. W. Weinberger, New York City. There is very little in the President's address that I can disagree with. There is one thing that I think ought to be brought up and considered, and that is the revision of the Constitution and By-Laws. A number of changes can be made which will benefit the society, if such a revision is undertaken.

With reference to the matter of general education of the orthodontist this is a serious and important question. It is really a dream to think it can be realized at the present time under present conditions, but I believe if some action could be taken by this society designating what constitutes a specialist and who can be eligible in the true sense, as members of this society, it would be a great step forward in the science of orthodontia. There are a number of small post-graduate courses that amount to absolutely nothing and I fear are doing a great deal of harm to the men who are trying to do sincere and honest work. I think that any action this society may take, if it is within its power to do so, would be a great help to these men in placing orthodontia on a definite scientific basis.

Dr. Martin Dewey, Chicago. I have not very much to say in regard to the President's address because I agree with it, especially with regard to the revision of the Constitution and By-Laws.

As to the statement made with reference to post-graduate courses, I cannot let it go unchallenged. Reference has been made to the inadequacy of present post-graduate instruction, one of the speakers saying that a post-graduate course of eight weeks is insufficient. If I remember correctly, some of the gentlemen present received their post-graduate instruction in such a school.

As regards the insufficiency of post-graduate work, one speaker made the statement that it is unfortunate the Angle school has been discontinued. We have all great respect for the Angle school, but some of us know that better courses are being given now than were given in the Angle school.

Another speaker (Dr. Weinberger) said that the present post-graduate courses of instruction do not amount to anything. That is an insult to a great many men who have taken these courses.

Several years ago, at the Toronto meeting of the society, I was instrumental in getting a committee appointed to investigate post-graduate instruction and to see that proper post-graduate courses were given. This committee has done absolutely nothing, so why criticize the post-graduate schools? Criticize your own committee. The post-graduate schools have been more anxious to have a rating than the society has been to rate them by concerted action.

Dr. Weinberger. Referring to the post-graduate schools in my previous remarks, I had reference more particularly to the condition we have in the East and no doubt elsewhere. In New York, there are a number of dental societies giving post-graduate courses and sending men out who later specialize. Those men have had inadequate instruction, the courses are too short and slipshod while the training is insufficient. Some definite action should be taken at this meeting with regard to these men who are turned out as specialists from such schools after a short course of instruction. That is the type of school I was referring to.

Dr. Hugh G. Tanzey, Kansas City, Missouri. I would like to comment briefly in regard to the experience necessary to practice orthodontia. It is generally recognized that we should know all we possibly can and have all the experience obtainable before commencing to practice orthodontia, especially before me make a diagnosis and give the prognosis; nevertheless the fact remains that we cannot all have a great deal of experience before we begin. I took a four or five weeks' post-graduate course (if you will pardon my speaking personally), after I had experimented in orthodontia for over ten years. Then I experimented two years more before I began to limit my practice, and I must declare that the greatest failures I have ever had have been since I have taken post-graduate work and have been limiting my practice. I do not think there is a man in this room who can say, after all his experience, that he has not had failures. The point is this: if you want to get anywhere in orthodontia or in any science, you must make a start, and I would say to the young man, who has made up his mind to be an orthodontist, "dive into it." I do not care what post-graduate work he does, if he is painstaking, he will work his way out, and if he is conscientious, he can do his work as well as many men who have had more experience. We are all having failures if we would only admit it.

In regard to the post-graduate schools that have been mentioned by Dr. Hawley and by Dr. Weinberger, I agree heartily with Dr. Dewey when he says that there are better post-graduate courses being given to-day than the course given by Dr. Angle. I do not see why the course of instruction should not be better. The men we have at the head of these schools to-day are ambitious, industrious and conscientious. They are thinkers and hard workers and possess the knowledge and practical experience to back up what they teach. This course will be found good enough if we will support the men and assist them in carrying on this course.

I agree with Dr. Dewey that the men who have taken such a course as he has referred to, cannot help but feel a little insulted at the remarks that were made. I am not referring to the short courses in orthodontia. Most men have taken at least one course, some of them two, and they are working to improve themselves, and that is about as good as can be done under the present conditions.

Dr. C. A. Hawley. I took a six weeks' post-graduate course myself, but I would have done better had I taken a longer course. That does not imply, however, that post-graduate courses cannot be improved. A six weeks' post-graduate course is of value, but a much longer course, where students cannot only put appliances on cases, but get the advantage of cases that have been under treatment, studying their progress from the beginning to the end, is of much more value. After ten or fifteen years' start of the first post-graduate school, we certainly ought to retain the progress that has been made. It would be better if we had.

I am sorry that Dr. Dewey or any man should misunderstand the purport of my remarks. I certainly did not mean to criticize existing post-graduate schools.

Dr. Dewey. Dr. Hawley has referred to a continuous course. In our school we have had a continuous course since 1912, the year around.

R. Ottolengui, New York City. Any legal practitioner of dentistry has a right under the law to practice orthodontia and when he voluntarily takes a post-graduate course in order to learn more than he was taught in the original school it is a matter for his own conscience to decide whether it is fair to the children of the community in which he lives for him to announce that he will make a special practice of orthodontia. I for one would dislike very much to see the society set up any special standard of what a man should accomplish in order to be recognized as a sufficiently educated specialist to become a member of this society. The society is intended to be a helpful means of developing the education of men who wish to be specialists. It seems to me that one mistake which has been made in regard to post-graduate schools in the past, and I think this is what the President meant, is that the schools have left the impression upon their students that if they graduate from that particular school they would then be competent to correct any form of malocclusion. Later on, these men learn by experience that this is not true.

Dr. Calvin S. Case, Chicago. I did not expect to be called upon to take part in this discussion. In the first place, I would like to compliment the writer of this address in regard to what he has said concerning orthodontia.

I am quite in accord with Dr. Hawley relative to the question of post-graduate schools or any school of orthodontia. As some of the gentlemen present are doubtless aware, whenever they have come to me for advice to attend any particular school, I have referred them to Dr. Angle's school, believing it was the best school I knew of. It is a mistake to think that a school stamps a man. It is the man behind the gun after all. No matter what school he attends, if he has the desire and the ambition to excel in orthodontia he will prosecute his studies in this branch, and it will be one of the acts of his nature to do the best he can. If you will pardon a personal allusion, if I were stamped on account of the school I graduated from in dentistry, having taken a course of only five months at that time, which you all know is very inadequate, the measure of my professional life would be poor indeed.

Dr. Ray D. Robinson, Los Angeles, Cal. This question of education, it seems to me, resolves itself into one of opportunity. I am a six weeks' man; some of you are six weeks' men, and some are eight-weeks, and there is not a man here who has taken six or eight weeks of post-graduate instruction, who would not have taken a year's course had he had the opportunity to do so.

In criticizing post-graduate schools of to-day, I do not think my friend Dr. Dewey will tell you or will tell me that his school is the best, although it may be, but, it seems to me, the American Society of Orthodontists ought to support some post-graduate school. Whether it is Dewey's school, or another organized by this society, or whatever it be, it is certainly within the province of this body to get behind such an educational movement. If Dewey's school has the start and this society wants to get behind it and push it and make it what Dewey would like to see it, then let us do it. If on the other hand, Dewey's school has not the standing or the start, then let us organize one; let us have some place where young dentists, who want to study orthodontia, can go and get all there is to give them in that specialty.

Dr. Burt Abell, Toledo, Ohio. The essayist has given us inspiration and food for thought, and we ought to be thinking along this line. I do not believe that any man who has taken a six or eight weeks' course feels it was sufficient.

When Dr. Dewey says there is a continuous clinic at his school, I would like to ask him if that is an answer to Dr. Hawley's suggestion? If these clinics are continuous, are they accessible to the men who have taken the course? I understand Dr. Hawley's contention was that when a man takes the lectures he should have a chance to develop the technique, and he can do that through watching these particular cases. I do not think there is any school which affords that opportunity. I think most of us would be willing to hold up both hands in favor of a longer course. I have felt the need of it in my practice since 1903. If I knew a boy or a man interested in orthodontia, I would try to send him to a school that gives a longer course. I would do it because he needs it.

Dr. E. G. Weeks, Saginaw, Mich. I took Dr. Dewey's course and I can testify to its being a continuous course. While I was there I took impressions of cases before the appliances were made or put on. I made appliances for the cases and followed up the treatment. I also had an opportunity to study models of cases begun by the classes which had passed through the school ahead of my class. We continued their treatment, took impressions of cases finished by former students and made retainers for the same. That I think must be considered a continuous clinic and such practical work is of great advantage to the student.

Dr. Ralph Waldron, Newark, N. J.

I have been very much interested in this discussion and I feel like a certain man who was serving on a jury in my town. During the trial two eminent lawyers argued the case *pro* and *con,* and after the jury had retired to bring in a verdict, this man said, "We have heard a lot of discussion but what is it all about?" I feel that the remarks of Dr. Hawley were misunderstood. My understanding is that the position taken by him was this: while a six or eight weeks' course is a very good thing, a year would be much better. I feel that the short courses given in New York by the First District Dental Society and other societies are excellent, because you can always learn something, and there is not a course, no matter how long it runs at the present time, which gives a man a certificate to the effect that he is well qualified to go out and practice orthodontia. It is a matter for the individual to decide, whether he takes a six or eight weeks' course. A year would be better by all means.

R. Ottolengui, New York City.

I am afraid that some of the gentlemen do not understand the situation in New York. While the First District Dental Society has been giving courses in orthodontia, they were study classes and orthodontia was but one of many subjects taken up in this manner for men who desired to hear lectures on special subjects delivered by experts. In orthodontia, there has never been any clinical work done and there never was any intention of stamping those who attended the lectures as qualified to practice as orthodontic specialists.

Dr. W. C. Fisher. New York City.

I am a student of orthodontia; you are specialists. I consider that a man who wants to get an education in the present day in any science can get it. I have not missed a meeting of this society for eight years or more. I have come here in order to improve myself in the knowledge of orthodontia. I have never left a meeting of this society without carrying away a good deal. I am surprised in these eight years that I have not found more students of orthodontia at these sessions. Where the fault lies, I do not know. The lack of attendance is not due to the society's not extending invitations. At the first meeting, which I attended I was given the courtesy of the floor but I have never availed myself of the privilege until this moment.

So far as criticizing post-graduate courses is concerned, I do not think anyone wants to criticize them in a depreciatory manner. They have done excellent work, and must go on doing good work until you can improve them. The whole thing has been summed up by Dr. Waldron when he said that six weeks is good; eight weeks is better, a year is still better, and two years better yet.

Dr. G. W. Grieve,
Toronto, Ontario.

This subject has been discussed in this society before, and I think we all appreciate the fact that it is not possible to get all the knowledge we would like to possess in a short post-graduate course. It seems to me, that this society should get behind a movement by which it would be possible to establish a first-class school in some large center in connection with a university, to get away from all commercialism entirely. We should try to establish some center where it is possible to obtain the services of men qualified to teach in such a school. The course should extend over a year at least.

Dr. M. N. Federspiel.
(Closing)

I appreciate very much the free discussion my paper has elicited. Some of you have misunderstood what I had reference to. My attack was on a class of men who are commercializing orthodontia. I had reference to the dollar school and the dollar orthodontist. It is unfortunate that you should attack this or that school, because if a man has a thorough early training in the fundamental sciences it is an easy matter for him to master any specialty. He is then in a position to concentrate upon the teachings outlined in the curriculum, but the curriculum must be right; it must be broad and comprehensive and not limited to the advertising of a system or a man. I remember when I took my course in the Angle School of Orthodontia we were supposed to use the author's appliance only, consisting of clamp bands, an expansion arch and ligatures, with little or no knowledge of retention. It took me ten years to unlearn what I learned in six weeks. (Laughter.)

This society has taken the lead in raising the standard of orthodontia, it is, after all, a post-graduate school; therefore, I would like you to be more democratic and charitable and to assist those who are weak in orthodontia. That is the purpose of our organization.

The Teeth in Superstition and Magic

By Charles Channing Allen, D.D.S., Kansas City, Mo.

Few dentists have ever given consideration to the large place the teeth occupy in magic, sorcery and folk lore, to say nothing of a goodly mention they obtain in general literature. Since the earliest times and among all primitive races, teeth, especially human teeth, have occupied an important place in magical ceremonies, sorcery, incantations, the practice of magic and the working of charms. The tribal magician or medicine man as he is better known in North America, would suffer considerable loss if he were denied the use of teeth in his practices. There is a new and particularly rich field to be explored by one who will interest himself in the curious historical tooth lore which exists and is constantly being added to relating to primitive, savage and barbarous peoples. Nor are these apparently foolish and useless practices confined wholly to the primitive and barbarous peoples. We find remnants of magical practices existing much more generally than supposed among people of the highest civilization of which we boast and those people of the greatest culture. Nearly everyone is constantly in his daily acts doing little things as charms or wards of evil or exhortations for luck who would scorn the implication that he was working the Black Art. Yet the same man feels a little elation perhaps and a sense of subliminal satisfaction if he sees the new moon over his right shoulder. These lingering superstitions which are dimly outlined, but no less indelibly fixed in almost every mind are the remnants of the ancient tribal beliefs and ceremonies of our savage ancestors. They are mental survivals long grown useless which correspond to such physical survivals as the muscles in the ear, the appendix, the third molars, and others which persist to plague or puzzle humanity. Nor can it be said that culture or intellectuality frees one entirely from this form of mysterious influence and among the more ignorant of our own citizenry, which is supposed to be the most enlightened in the world, they often amount to a baleful slavery. Long lists could be made of the personal superstitions of great men. Nearly every statesman, poet, philospher or scientist has in some small way paid tribute to the long forgotten ceremonies, incantations and beliefs of the Magi. We are no less the unconscious votaries of Black Art. Many is the farmer who carefully considers the phase of the moon when planting his crops. It would be an almost interminable task to catalogue the superstitions common to the daily lives of peoples of all lands and races. But we may refer to a few with which we are all familiar.

Modern Superstitions.

When you awake in the morning you are apprehensive if you have dreamt about snakes or a dozen other things which are ominous. You are careful to put your right shoe on first, and if you sing before breakfast you cry before night. If you accidentally spill salt at the table you quickly throw a pinch over your shoulder. If you take an umbrella from the rack and start to raise it in the house there is a domestic tumult. Having left the house if you should return for a forgotten article you must sit down and count ten or your day will not be fortuitous. If a black cat runs across your path it is a sure sign of bad luck and if you shudder you know someone has walked over your grave, notwithstanding the fact that you are not yet a tenant of the narrow cell. If you meet a cross-eyed person you must find a four leaf clover or some other talisman to remove the hoodoo. When you pay your car fare you must be careful not to lose the buck-eye you are carrying for your rheumatism or spend your lucky piece, to say nothing of the potato you used to carry before the lowly spud ranked as a gem. When you look at your timepiece you toy for a moment with the rabbit's foot that adorns your watch chain. If you open your morning paper and should note that it is Friday the thirteenth you would certainly refrain from any new business venture that day. If, when you step from the street car, you notice a three pound horseshoe in the street, you will, of course, pick it up and lug it around all day. If there is a ladder leaning against the side of a building you are careful to walk around it. If there happens to be a hunchback in the elevator as you mount to your office you will, of course, be careful to surruptitiously touch the hump. If an office friend gives you a knife or an ivory handled paper cutter you hand him a penny because the instrument is sharp and you must purchase it to avoid cutting friendship. Before going home in the afternoon you purchase an emerald for your wife because an opal is unlucky. When you step from the car and see the new moon over your right shoulder you make a wish and turn over the silver in your pocket. Later you retire to sleep and let us hope to lucky dreams.

These are only a few of the superstitions that beset your daily routine. In all this we have made no reference to the teeth, yet in the original causes of all these superstitions and customs we find the teeth have played an important part.

Modern Superstitions About Teeth.

Knocking out of certain teeth is practiced as a principal ceremony of initiation among certain Eastern Australian tribes. It is also practiced by Central tribes of the lonely continent although not as an initiation rite. The hypothesis upon which they proceed is that a tooth, being a vital part of a man, its sacrifice will help insure to him another life after death, and it is supposed that a tooth is chosen because of its well known durability compared with the corruptibility of other portions of the body. The extracted tooth is believed to remain in sympathetic connection with the man from whom it is removed. And these extracted teeth were carefully cared for lest the former owner fall ill. With some tribes the mother of the lad initiated, according to custom, chose a young gum tree and inserted her son's teeth in the bark at the fork of the two utmost boughs. This tree was afterwards held sacred and was made known only to certain persons of the tribe, but the youth himself was never permitted to know where the tree was. If the boy died the tree was killed by fire. Other tribes would throw the teeth as far as possible in the direction the mother was supposed to have once camped. It was the custom of another Australian tribe to bury the teeth by the side of the pool for the purpose of stopping rain. When the teeth were inserted in a bark of a tree near a river or water hole, if the bark grew over the tooth or if the tooth fell into the water all was well, but if the ants ran over it the boy would suffer from a disease of the mouth. This is very clearly the origin of pyorrhea, which has been so long and laboriously searched for by our prominent bacteriologists.

Among the Murrang and other tribes of New South Wales the extracted tooth was first taken by an old man and passed from one head-man to another until finally it was returned to the boy's father and then to the lad himself. But in this journey it must on no account be placed in a bag containing other magical substance, for that would endanger the young man. A man of the Murrang tribe traveled two hundred and fifty miles to fetch back some teeth because one of the boys to whom they had belonged had fallen into ill health and the old man believed some injury had befallen the teeth. At other times the boy's father or next of kin would carefully bind up the teeth in emu feathers until after the mouth had healed. After this the teeth were treated in a magical manner in order to take the supposed life out of them. This interesting process consisted of the man making a low, rumbling noise without uttering any words, blowing two or three times with his mouth and jerking the teeth through his hand to some little distance. The teeth were then buried about eighteen inches under ground. Failure to do this would have made the boy liable to an ulcerated and wry mouth and ultimately to a distorted face.

For some curious reasons the Central Australian tribes generally associated the extraction of teeth with rain and water. In the Warramunga tribe they generally knocked out the teeth about the end of the wet season when they did not wish any more rain. The ceremony always took place on the banks of a water hole. When the natives of the York Peninsula in Queensland are preparing to knock out the young man's tooth they mention the various districts which the relatives or parents of the young man have owned or frequented and the name which is uttered at the instant the tooth flies out is the country to which the lad is accredited as a citizen. This is an easy method of determining citizenship which sometimes might be used to advantage nowadays. Further, when the young man spits the blood out on the ground the old men examine it to find trace of a likeness to some animal or plant and the fancied likeness determines this man's totem.

A certain African tribe seems to be especially subject to lockjaw and in order to combat this distressing disease they resort to a rather heroic preparedness by knocking out some of the teeth. The Malagasy think only people with good even teeth should plant maize, otherwise there will be empty spaces on the cob. Tribes in Eastern Peru think that to carry the poison tooth of a serpent is a protection against the bite of a serpent, and their infallible remedy against toothache is to rub the face with the tooth. Some Brazilian Indians hang the teeth of an animal called the grass-eater around the girl's neck at puberty. What particular purpose that answers does not appear.

The ancient Greeks used to think they could dye their hair black with raven's eggs, but while they were doing this it was necessary to keep the mouth full of oil otherwise the teeth also would be dyed black. The Galelarees think when the teeth are being filed you should keep spitting on a pebble, for this establishes a magic connection between you and the pebble. Henceforth your teeth will be hard and durable as stone. They also believe you should not comb a child's hair before teething, otherwise the teeth will be separated from each other. The Basutos carefully conceal their extracted teeth to keep them out of the hands of a mythical being called Baloi. These beings haunt graves and if they found the teeth they could injure the owner by working magic upon them.

English Superstitions.

There are still people in rural England who will not throw away children's cast teeth believing if they were found and gnawed by an animal the children would have teeth like that animal. They proved this by citing cases of supposed resemblance of certain human teeth to animal teeth. Upon the same principle in other parts of the world teeth are placed where they will be found by rats or mice in order that the former owner may have the fine teeth of these rodents.

German Superstitions.

In Germany there is a maxim which bids you put your tooth in a mouse's hole. To do so with a deciduous tooth prevents the child from having toothache. Or you should go behind the stove, throw your tooth backwards over your head and say, "Mousie give me your iron tooth. I will give you my bone tooth." If we were all careful to follow this simple formula, it would be wholly unnecessary to bother our heads about professional advancement. The German children also say, "Mousie, mousie, come out and bring me a new tooth." Or, "Mousie, I give you a little bone, give me a little stone," or, "Mousie there is an old tooth for you, make me a new one." This ceremony is believed in Bavaria, to insure that the teeth will be as white as the teeth of mice. The South Slavonian children throw their teeth in the corner say, "Mousie, there is a bone tooth, give me an iron tooth."

Russian Superstitions.

The Jewish children in South Russia throw their teeth in the thatch roof with the same request to the mousie. You will notice the similarity in Raratonga, in the Pacific, where the child offers the following prayer when the tooth is extracted:

"Big rat! Little rat!
Here's my old tooth.
Pray give me a new one."

Then the tooth is thrown on the thatch of the home because the rats make their nests there. The rats have the strongest teeth known to those natives. A very similar ceremony is observed in the Sarangalas and Gorong Archipeligo. In the Kai Islands, to the southwest of New

Guinea, the child is lifted to the roof in order that he may deposit the tooth himself, with a similar invocation to the rats, with this difference—he requests a golden tooth instead.

Mexican Superstitions.

The same custom exists in Mexico where the father believes if the tooth is not put in the mouse's hole there will be no new one issue from the gums. A more barbarous application of the same principle is the Levabian superstition that you should bite off the head of a living mouse when the child is teething and hang the head around the child's neck by a string, being careful not to make a knot in the string. This will make the teething easy. A very simple procedure indeed, but the Bohemians have improved upon it. They recommend the use of a red string with the heads of three mice upon it instead of one. We have noticed the widespread fame of the rat and mouse as a producer of sound teeth, a fact which has heretofore been overlooked by the gentlemen of our profession.

There are other animals that claim a portion of this distinction. The Singhalese invokes the squirrel. Again, in parts of Bohemia, the fox is asked for an iron tooth instead of a bone one. In Berlin, the teeth of a fox are worn as a necklace around the throat, and make teething easy as well as insuring good and lasting teeth. The children of Victoria fasten to their wrists the tooth of a kangaroo with which they are to rub the gum. The Cherokee Indians supplicate the beaver to put a new tooth in their jaw. In Macedonia the child keeps his cast tooth for a while, then throws it at the roof and invokes the crow. It would seem the crow was poorly equipped to supply teeth of any kind yet he is addressed as follows:

"O dear crow, here is a tooth of bone,
Take it and give me a tooth of iron instead."

The Thompson Indians of British Columbia hide the cast teeth of their children in raw venison and give it to the dog to eat, with the idea doubtless that this insures children strong fine teeth such as the dog had. Mothers of Silesia frequently swallow their children's teeth in order to insure them against toothache and perhaps strengthen the weak teeth of children by the strong teeth of the adult.

In Central Australia when a girl's tooth is knocked out as a ceremony, it is pounded up, fragments placed in a piece of meat and eaten by the girl's mother. When the same rite has been performed by a man the pounded tooth must be eaten by his mother-in-law. The Arab boy throws his tooth towards the sun and asks for a tooth smooth and white like a hailstone. The peasant people of Lebanon say to the sun, "Sun, sun, take an ass's tooth and give me a deer's tooth.

Cures for Toothache.

There are many and curious empirical methods of treating and curing toothache. A piece of mistletoe hung around the neck is used in some parts of England as a remedy for toothache. Sometimes a double hazel nut is carried in the pocket as a ward against toothache. Another old English custom in cases of toothache was to puncture the gum with a nail, then drive the nail into one of the roof beams, or rafters. This treatment not only cured a toothache but insured against its recurrence ever after. To secure yourself from toothache you will be told in Sussex to be careful always to put on the right stocking before the left, and to put the right leg into trousers before the left. In Lancanshire, charmed belts or a cord around the loins is worn to ward off toothache. In other localities a tooth taken from the mouth of a corpse is often enveloped in a little bag, and worn around the neck to secure the wearer against toothache. St. Appollonia was the chief recognized healer of toothache despite the incessant mention of St. Peter in Charues. At her martyrdom in Alexandria under the Emperor Phillip, her teeth were beaten out. Her emblems are, "Holding a tooth in pinchers. Her teeth pulled out. Pinchers in left hand; tooth in right. Pinchers alone. Tied to a pillar and scouraged." St. Lucy also divides honors as the national saint against toothache. Without the least suggestion of irreverence we frequently find the name of our Saviour connected with what might appear to be as trivial and Apocryphal legends in connection with the cure of sickness. There are many legends of this kind extant. Sometimes the legends are difficult either to explain or trace. This may be well illustrated by the charm for toothache which is popular among certain English peasants. One version runs:

"Christ pass'd by His brother's door,
Saw His brother lying on the floor.
What ailes thee, brother?
Pain in the teeth?
Thy teeth shall pain thee no more."

According to Astemidorus the loss of a right or left tooth presages the death of a male or female relative.

In Lancanshire the following is frequently worn sewn inside the waistcoat or stays, and over the left breast: "Ass Sant Peter sat at the geats of Jerusalm our Blessed Lord and Saviour Jesus Crist passed by and sead, 'what eleth thee?' Hee sead, 'Lord, my teeth ecketh.' Hee sead, 'arise and follow mee, and thy teeth shall never eake eney mour.'"

There are some references to the teeth in the Bible, but there seem to be more in the Talmud according to which the teeth of foxes have the power to cause or prevent sleep. The teeth of a live fox would prevent sleep; the teeth of a dead fox produced sleep.

For much of the valuable material in this paper I am indebted to J. G. Frazer, D.C.L., L.L.D., Litt.D., and W. G. Black, as well as the late Dr. John J. R. Patrick.

Discussion on the Paper of Dr. Allen.

Dr. Ottolengui. I am a little bit handicapped in not having had a copy of this paper in advance, because while I am not a magician myself I have read a number of works on the subject of magic and recall having seen in them many remedies for toothache. I was particularly interested in that part of the paper where we find that a child who loses his deciduous tooth appeals to a rat or a mouse for one that is better. I believe that we can manage many children through their imagination, which indeed is a part of the science known as child psychology.

I had a little girl patient recently for whom I wished to extract a temporary tooth, but she objected strenuously, so I said to her, "The tooth is very loose and will not hurt and after it is out I will fold it up for you in a nice clean envelope and you take it home; when you go to sleep to-night put it under your pillow; then when you wake up in the morning look under the pillow the very first thing and in place of the tooth you will find a nice new dollar." This attracted her attention at once but it also attracted the attention of her father who was present and he remarked, "You have that wrong doctor; in our house a tooth put under the pillow changes into a dime, not a dollar." (Laughter.) This remark on the part of the father interfered somewhat with my application of child psychology.

This matter of child psychology is quite important and whilst I believe that the highest success in practice must come almost by intuition, still there are some good works on the subject that it would pay many of us to read. I was very much pleased this winter to know that the girls who are studying to be hygienists in a school in New York City have regular lectures on child psychology by a specialist in this science.

Dealing with children, a great deal can be accomplished by appealing to their sense of personal esteem. As an example, I had two children under my care this winter, a sister and brother. The boy was the older and was very nervous and apprehensive, whereas the younger, the girl, was quite phlegmatic. Almost anything that I attempted to do for the boy would be met by the query, "Will it hurt?" So finally I asked him, "What does that word 'hurt' mean?" He said, "Why, you know." But I assured him quite seriously that I did not know the word at all and I asked him if he thought he could show it to me in the dictionary. He at once offered to do so. My office assistant brought out the dictionary and the boy looked for the word. When he came to the place where it should be, to his surprise he found that the word had been cut out and he remarked, "Why it isn't here, somebody has cut it out!" and I answered, "Yes, we cut that word out long ago from our dictionary because we have no use for it in this office." Not willing to be entirely outdone, the boy said, "I am going to look for 'pain,'" and immediately turned to the Ps. Fortunately for me, however, that had been cut out also. Still this did not entirely change his attitude of fear towards me; so one day I said to him, "Son, I cannot tell from the way children dress nowadays whether they are boys or girls. I have to decide sometimes by the way people act, and from the way you behave I sometimes think you must be a girl." He asked "Why?" and I said "Because little girls always complain about everything, but boys never do, because boys know that they are nothing but little men and men never complain." Next time he came in I said to him, "Mollie, don't do that." He retorted, "My name isn't Mollie, it's Bill" and I answered, "You don't act a bit like a boy named Bill, so I thought you were a girl." The second or third day on which I called him Mollie he turned to me with a half grin on his face and said, "Doctor, I get you; go ahead with your work." (Laughter.)

I really borrowed that idea from the mother of another boy who began to be fidgety in the chair when his mother said to him, "Charles, are you a man or a mouse?" He replied at once, "I am a man, Mother" and then turning to me added, "But wait a minute, Doctor, did you ever do anything like this before to a little fellow like me?" and I answered, "I have done it to boys much smaller than you and also to girls." At once he replied, "Then you can go ahead." (Applause.)

Thus we can make use of psychology and lead the minds of children away from the notion of pain, but it is very necessary that you keep all of your promises and never promise what cannot possibly be performed. It has long ago been pointed out by a good psychologist that mental anticipation plays a large part in realization, that is to say if a patient anticipates or expects to be hurt, the slightest unpleasant sensation becomes real pain. On the other hand, if a patient is assured that he is not going to suffer, a little pain will only appeal to him as an unpleasant accident.

Dr. C. C. Allen. A curious fact which I learned in pursuing these studies is this, that very similar practices obtain in all parts of the earth, in places so far apart that we know that for many thousands of years the inhabitants could not have had communication with one another. Therefore there seems to be a common origin of superstition, and superstition is the beginning of knowledge. The very first professional man who differentiated between himself and the common laborer of all tribes was a magician, or as we know him now, the priest or medicine man, and in the original scheme of things these men were the brightest of the tribes, and generally they were honest. They were not charlatans. Out of that came the professional man and the priest. Again, not all of them remained honest; they took advantage of these imcantations to deceive the people and to bring themselves into prominence and prosperity. But originally they started out as good men, while we may look upon these things as strange and foolish, in the days of long ago they were practiced honestly. I think sometimes in the years to come, when the people on the earth look back upon our present practices, they will consider them as foolish as some of the things I have told you about. So we are not to make fun of these folks. I do not feel we should do so myself. I thank you very kindly for your attention.

Teaching of Orthodontia from the Standpoint of the Student.

By Dr. William C. Fisher, New York City, N. Y.

When the Chairman of the Committee in charge of the program for this meeting asked me to present a paper, giving me the above title I refused, stating, that I considered the subject could be treated only by someone who possessed a qualification, that I, as a student, did not possess; namely, a diploma from one of the known private schools. This deficiency, he very promptly informed me, did not disqualify. He dismissed my other exemption claims as fast as I could present them, and so I at last found myself a conscript. Indeed, if our Government has any great difficulty in handling the exemption excuses of its conscripts, I can heartily recommend to it, the services of the Chairman of your Board of Censors.

Of a volunteer we demand *duty* plus *valor,* while of the conscript we demand *duty* only. So be kind enough to bear this in mind.

That there is something radically wrong with the facilites, if not methods of teaching orthodontia to-day, nearly every student of this specialty is quite willing to admit.

I do not possess, therefore I cannot offer a solution of the entire problem, but I hope I may be able to stimulate here a discussion that will assist in outlining a workable plan, that will ultimately solve this very important matter.

Orthodontia has been recognized as a specialty now for a good number of years; ten, perhaps twenty years. That, to-day the young graduate either knows little more, or else is little more interested in it than the graduates of ten or fifteen years ago, and that during that period, it has been necessary for him to attend private schools, for special instruction, is proof sufficient that there is something wrong with the present teaching of orthodontia.

And the further fact, that many so-called specialists, graduates of these private schools, often have as their only qualifications, an additional amount of knowledge of the methods necessary to this special work; but without that broad view of the general practitioner, is additional evidence of a fault somewhere in the orthodontic and dental curriculums, both.

Success in orthodontia, means successful correction of malocclusions, which in itself demands a full understanding of normal or ideal occlusion, together with much other knowledge.

Why are not general practitioners impressed with this important knowledge as are the orthodontists from private schools?

With a clear knowledge of occlusion and the importance of the preservation of the mesio-distal diameter of the teeth, especially of the deciduous molars, how many, many cases of malocclusion, could be prevented and later orthodontic interference be practically unnecessary!

Plea is often made that a busy general practitioner cannot spare the time needed for orthodontic work. This is a wrong idea and should not be considered a just excuse; any more than you would excuse a general practitioner, for the same reasons, from performing any other character of mechanical construction. And many of us lose sight of the fact, that in small communities, the general practitioner is compelled to care for every character of dental work. His responsibilities in regard to orthodontia are just the same as to exodontia, minor oral surgery, prosthodontia, etc. Have we trained him to properly meet that responsibility? If not, wherein have we failed?

University System Recommended.

Just as the privately owned and controlled dental schools are almost a thing of the past, and our students may now receive instruction in dental departments of well regulated and high standard universities, so must the privately owned and controlled orthodontic schools, surely give way to well standardized post-graduate schools, under the control and supervision of our leading universities throughout the country.

Further, if these post-graduate courses are held, as they naturally would be under any such plan, in or near our large cities, and were made to cover two years of six months each instead of two months, and the hours of instruction so arranged, that they would not compel a man to devote more than four half days per week, more men could then avail themselves of such instruction and still conduct their practices. Another very great advantage (which is absolutely impossible in the present eight week private school courses) would be that a student could see the progress of the methods in practical treatment of clinical cases, and often bring these cases in a two-year course to a somewhat satisfactory conclusion.

Still another advantage to be obtained by the establishment of post-graduate schools of orthodontia, and their proper standardization, would be *ipse facto,* the standardization of the term "Orthodontic Specialist"; which term now any dentist may appropriate at will.

Not that I would for one minute be understood, that I would not allow a general practitioner to practice the specialty; on the contrary, I think more general practitioners should be encouraged to take up the practice of orthodontia, along with their other work. This is what good post-graduate courses should accomplish. If he so wishes, and finds himself well qualified to do the work successfully, and particularly loves it, you may find him dropping his general practice and devoting his whole time to orthodontia. That is, if he is in a community that can support him in the practice of a specialty.

We find among general practitioners many, who apparently have no desire to inform themselves about orthodontia. Would this condition exist *now* if the teaching of orthodontia in our dental schools had received its proper direction, during the past ten or fifteen years? I most emphatically do not think so. Therefore, if the course in orthodontia in our dental schools be made of sufficient importance, we shall in the future find the graduates, more interested in this special work and more capable of practicing the same and more desirous of increasing their knowledge by attendance at the post-graduate schools. And the post-graduate schools, conducted on liberal and large lines, will serve the double purpose, of correcting the aforementioned apathy of the general practitioner and furnishing the opportunity of the interested, improving and perfecting their natural desire for specialized work. And further, there will result, what I believe, is the greatest of all good: that is, by the interest in orthodontia that will be stimulated, and the higher degree of mechanical ability, that will be developed, there will obtain a higher idealism and ability throughout the entire professional field. Remember that the profession will advance, only in proportion with the advancement of its educational institutions.

We are extremely fortunate, in having to-day, in every large city, one or more men of recognized ability in the specialty of orthodontia, who could and I am sure would, serve on the teaching staff of such post-graduate schools. In particular cases they might well be organized, before affiliation with some university, but I want to emphasize the fact that only with that end in view are we justified at the present date in organizing what might be understood as quasi-private institutions.

It would, of course, be better, could the original organization be made under the direction and control of a university with a dental department; thereby availing ourselves of the aid of collateral teachers and research workers, also drawing from their abundant clinical facilities.

Another much desired condition, and this can apply to both the teaching of orthodontia in the regular courses as well as the post-graduate courses, is a standardization of this subject, for every section of the country, so that, just as good specialists can be developed in the West as the South, and in the South, as in the East.

Like all great advances in scientific and educational work, mistakes will be made; severe adverse criticism will be heard; but these should not discourage, but should rather stimulate, a greater effort to bring about an almost satisfactory, if not ideal, curriculum.

Discussion on the Paper of Dr. Fisher.

Dr. Martin Dewey, Chicago.

Mr. President and Members of the American Society of Orthodontists: The question of teaching orthodontia from the standpoint of a student requires a great amount of consideration, and it is something that must be approached from a great many angles. As the essayist took up the consideration of teaching orthodontia in the dental colleges, we have a condition existing there which some of you are aware of, and in calling attention to this condition it refutes to a certain extent the argument made by the essayist regarding the establishment of post-graduate schools in universities. In the first place, the majority of large universities have no orthodontic department in their dental schools. An institution that does not recognize orthodontia in the ordinary dental curriculum as being of sufficient importance to have a professor of orthodontia is certainly not an institution to have charge of post-graduate instruction.

That is one of the first difficulties we have to contend with. We have orthodontia taught in some of the dental schools by the Department of Prosthesis. They have no separate orthodontic professor. We also find undergraduate students are handicapped because corelated subjects are not properly taught. In the department of dental anatomy should be taught the occlusion of the teeth. That is done in very few schools. The professor of histology should teach the relations of the dental tissues in regard to tooth movement. That is not done. The teacher of dental anatomy and physiology should teach such things as are related to the anatomical conditions found in malocclusion. That is not done. In other words, the student who leaves a dental college after taking a dental course has to receive instruction in a great many things before he is qualified to receive proper orthodontic instruction. That is one of the first things we have to consider from the standpoint of teaching orthodontia. Now, we realize that orthodontia as taught to the average dental student is not sufficient to qualify him to treat malocclusions, but is the dental student any more handicapped than the medical student who leaves a medical college without being qualified to practice surgery before taking a course in a hospital? Is the medical graduate qualified to make bacteriological diagnosis in a pathological laboratory before taking a special course? In other words, is the instruction received in orthodontia any more deficient than the instruction received in a great many branches of medicine? Can you expect a dental college to make a finished orthodontist out of every dental graduate? You certainly cannot. You cannot expect medical colleges to turn out finished pathologists nor finished specialists qualified to treat the diseases of the eye, nose and throat.

I have already called attention to the fact that there exists in the minds of some people an idea that the solution of every educational problem is to affiliate it with some large university. We hear men talk about the superiority of dental schools connected with universities, but if you are interested enough in this subject, to examine the reports of State Boards, you will find the largest percentage of failures comes from the dental departments of universities. That is proven by reference to the reports of the National Association of Dental Examiners. The privately owned institutions, which are always looked upon as being insufficient, have a higher percentage of graduates who pass the State Boards than do the universities. It is a fact that the graduates of a certain university have fallen so low in their examinations before State Boards that the institution is contemplating resigning from the National Association of Dental Faculties because of the high percentage of failures. Are you willing to have orthodontia taught in such schools when students can be better prepared by taking post-graduate courses? I do not think you are.

I have had some experience, as you know, in regard to privately owned dental schools, and I have had experience with the medical and dental departments of large universities and experience in post-graduate schools. I have been offered at various times the opportunity to establish a department of orthodontia in two large universities. At one time I almost perfected plans to that end, but finally we got to the point of completing the plans when I found that the university wanted to assume absolute control, which you may say is all right. But what assurance did I have that they knew how to run a post-graduate school? In other words, they would assume everything, and I was to work on a certain definite salary under someone else and not say what should be taught. That I refused to do. We do not claim that the present type of post-graduate schools is perfect. Nothing is perfect, but we do believe a better post-graduate school can be conducted under the control of one man, who has devoted time and thought in giving the course than can be given by the dean of a dental school who has absolutely no knowledge of post-graduate instruction.

Appropriate Length of Post-graduate Course.

The question of a six months' course or a two years' course has been mentioned by the essayist. If you will stop and consider dental colleges and the discussions they have had with regard to a three and four year course, you will find they have had great trouble in raising the curriculum. Now you want to insist on dental students taking four years of dental college instruction, and two years' post-graduate instruction in orthodontia, so that by the time a man gets through with his professional course he is ready for the old folks' home. You cannot expect a man to spend two years more after he has gone through his dental course to complete his post-graduate course. How many of you will do it? Many who have criticized short courses have taken short courses, and some say that we should now make the courses longer. To be honest with yourselves, how many of you could leave your practices for two years to take a post-graduate course? This thing must be practical as well as efficient, and I do not believe it is practical at the present time to give a post-graduate course of two years because you would be limiting it to a certain few. The man who can leave his practice and undertake a year's post-graduate course would be the man who had an unlimited amount of money, and he would acquire the habit of going to school. The best student is the one who has to put himself through school, who sends himself to school, and the fellow who could spend two years in taking an orthodontic course would be the one who was sent to school.

The need of orthodontic work to-day is imperative. There are a great many malocclusions to be treated, and you can render people a greater service by arranging courses that are practical, that is, of sufficient length so that a man can leave his practice and take these courses, than you will by carrying out the Utopian idea of having a two or one year's course. You must remember that this thing must be put on a practical basis. The statement has been made that a man who goes out of a dental college and specializes immediately is not as efficient as the one who develops more mature judgment.

Standards of Orthodontic Instruction.

The standard of orthodontic instruction is an important subject. As I said this morning, and the Committee on Dental Education will bear me out, I was instrumental in asking for the appointment of such a committee. We realize that orthodontic instruction must be standardized. We realized at that time that in the course of a few years there would be a number of post-graduate schools devoted to the teaching of orthodontia especially if one school seemed to be successful. The penality of success is imitation. If any school succeeds in getting a number of students and seems to be successful, somebody will try to do the same thing. The American Medical Association has worked for the standardization of medical colleges for years; and the American Society of Orthodontists should control post-graduate orthodontic schools, and it should go further and have something to say in regard to the course in orthodontia that is taught in dental schools. We should try to make the courses practical, and not work upon the proposition that because a two years' course seems to be Utopian, it is the only thing that can be given.

What is a Specialist?

The question has been brought up as to what constitutes a specialist. That probably will never be satisfactorily answered. Some have advocated a special examination by State Boards for those men who are going to be specialists in orthodontia, but the average State Board does not know as much about orthodontia as the man who is aiming to be a specialist in orthodontia. The question has been raised that the man who specializes in orthodontia may not be able to pass a general dental examination before the Dental Board on other subjects. There is some room for argument on both sides of the question, but I think it would be much better to require a man who specializes in orthodontia to pass an examination in the entire dental field than it would be to license him on his ability to practice orthodontia. In the medical profession, if a man wants to practice surgery, he has to take an examination on all medical subjects. The dental profession has succeeded in certain States in getting what is called reciprocity, that is, if you register in one State you can register in another if you do the practical work. If they are going to recognize you by reciprocity they should do it; but they only partially recognize you. Reciprocity from the standpoint of the orthodontist is an absolute joke because he has to do certain things which he has not done for years—to make gold crowns and plates, etc. In other words, he is examined on subjects which he has no intention of practicing. The State Boards say: "We do not license you to practice orthodontia; we have licensed you as a dentist, and you may then turn around and do general dentistry." From a legal standpoint, he who poses as an orthodontist can be held to a greater account than one who does not pose as a specialist. The man who poses as a surgeon is expected to obtain a better result from an operation than a general practitioner. The man who poses as a rhinologist must achieve better results than a general practitioner of medicine. The specialist is expected to get results beyond the average, but I am sorry to say that a large number of our results are not beyond the average, so that question will probably be one which will not be settled for some time to come.

Post-graduate Courses for Dentists.

The essayist also mentioned the fact that post-graduate instruction in orthodontia would be valuable to general practitioners of dentistry. That unquestionably is true, but if you go back to the old proposition, no matter how valuable such a course is to the general practitioner, the course must be given in such a manner that he can take it or it will be absolutely impractical.

The question of taking post-graduate instruction in conjunction with a general practice, as the essayist has outlined, is not satisfactory. In the first place, because there is an old saying that you cannot do two things at once and do either one well. You cannot conduct a general practice and study orthodontia at the same time satisfactorily.

The essayist has suggested that we give a course extending over a considerable period of time, devoting say four half days a week, or something like that, to the study of orthodontia, which will enable the students to devote time to their general practices and at the same time take the course. I believe that we can accomplish more by intensive teaching in a short time than we can by stringing the instruction over a long period where other things interrupt it.

He calls attention to the fact that in every large city the orthodontic specialists of recognized ability would serve on the teaching staffs of post-graduate schools. That has been tried by the Forsyth Infirmary. They selected the men who should give instruction, but I know that the majority of men who have been asked have refused. The man who has a busy practice in orthodontia, if he is wise, will not encourage such a plan of teaching orthodontia. Men with large orthodontic practices will not devote a lot of time to post-graduate teaching. You have got to put this thing back on a practical basis again, and if you do men will not be willing to make a definite sacrifice to teach in a post-graduate school. That is true in any line of teaching, and because a man is a successful practitioner of orthodontia or of any branch of dentistry or of medicine, is no sign that he is a good teacher. The worst failures in medical and dental colleges have been among the men who have been selected as teachers because of their practical ability. They have almost invariably failed as teachers. Teaching orthodontia or any branch of dentistry requires a certain amount of skill, a certain amount of preliminary training in normal schools, which the average dentist has not had. There is a large field for discussion which the essayist has opened up, and it will have to receive considerable attention. But a lot of the things he suggests are impractical and they have been thought of a great many years before he suggested them.

Dr. W J. Brady,
Kansas City, Mo.

I feel that much more might be said on the subject, although Dr. Dewey has expressed my sentiments in the matter very clearly. As many of you know, I have had some experience in teaching orthodontia, having put in twenty years on it under all sorts of circumstances in privately owned schools, in the large universities, and in privately conducted post-graduate schools, so I believe I may speak with some authority. While I am a graduate of a State university of which I am proud, and by which I have later been honored by being chosen as a teacher, and while I regard this institution very highly, yet I know that with all the great resources of a State behind it it fails to be competent to teach orthodontia as we would have it taught to those specializing in the work. I know because I have tried it myself and because others have tried it. I did not have any success with it and they have not had much better. The reason, however, is not because the great university was supported by the State, but it is found in the fact that the average dental student does not possess the maturity to study orthodontia. Orthodontia is peculiarly post-graduate work, and it is only the men who have had opportunity to think, who have been compelled to think over the great many subjects that are brought up in the post-graduate study of orthodontia, that have the real depth to undertake the work and to succeed with it. Now, those who have studied orthodontia in the private schools, the semi-privately owned schools, have done this thinking. They have done it whether they wanted to or not, and when they come to the privately owned school they are ready to take up intensive study of what must be given. For instance, a course of lectures can be given in six or eight weeks without any trouble, or without any particular trouble on part of the men getting it. If men study it in this way after they have had the time to think maturely on some of the problems, they actually get more and carry away more than if they have that same course strung out for a considerable period of time, say a year or two years. The trouble does not lie in the failure to back the schools to try to teach orthodontia. Teachers in some schools do their best and have good opportunities to do their work, but students do not get it. Why? Why does not the three year old child, or the six year old child get trigonometry or Latin? Why is the child given the first reader? Because it is suited to him. He can only assimilate material of that kind. The dental student can only assimilate certain amounts of material, and for that reason does not grasp orthodontia. Orthodontia taught in a regular course will not be a success for a long time. I wish it could be done to-morrow, but it will not, and until the time comes certain men will have to get their instruction from men like Dr. Dewey, who has an organized school and teaches orthodontia. It is the only place where a practical knowledge of orthodontia can be had.

I am glad to have heard Dr. Dewey bear down on the practical side because practical things are what count with practical men, and men who have been in practice for a long time must be practical or they will go back to the milk wagon, the plow, or to the insurance agency to which they are better suited.

I want to compliment the essayist because he has made an effort to bring about something for which he evidently feels deeply, and among them he feels that our present methods of orthodontic instruction are inadequate. The remedy does not lie in the planning out of the course to be given in a great university. I might say, that the big university is the hardest place to get anything done of any place on the face of the earth. Give me the privately owned school when it comes to getting something. I have been there and I know. I know it is the experience of every man who has ever taught in any big university, that universities do not have money enough to carry on the various departments. Big universities are generally hard up, and the bigger the university the harder up it is from the standpoint of money.

Dr. C. A. Hawley, Washington, D. C. I think we have had this subject very nicely and very clearly presented this morning and yesterday afternoon, and I wish to say that the general feeling of the society has been expressed by Dr. Robinson. It is a matter of opportunity. We should have greater opportunity for studying orthodontia than we have to-day. To my mind, notwithstanding what Dr. Dewey and Dr. Brady have said, I feel in regard to the teaching of orthodontia that there should be more institutions in the United States where a man can take a post-graduate course in any subject in dentistry, at any time, during the regular school session, where he can do special work in pathology, where he can study all the different branches of dentistry, and with it orthodontia. I do not believe success would be as great in a one man school as in a school where the instruction is given by different men; and in that school a course in orthodontia could be given. There should be competent men in charge of the institution, and students should have an opportunity to come in contact with a number of men, and we should have a school where a general practitioner could go at any time during the school session and get a certain amount of instruction. If he wants to take a six or eight weeks' course or a three months' course, he should be able to take it, but there should be a definite course for a diploma and my idea is that that course should be a year long to receive the recognition of the profession. I say a year long, because it is necessary to have that much time to get clinical work and the practical experience one should have. Conditions are different to-day from what they were ten years ago, and we know better to-day than we did ten years ago how instruction can be best imparted. I think with some additions, the plan the essayist has outlined is one that would finally raise the standard of instruction in orthodontia higher and afford greater opportunity for the study of orthodontia under mdern conditions.

Dr. D. W. Flint, Pittsburg. When a boy goes to dental school he goes for a certain purpose—he goes to learn how to fill teeth and how to make plates, etc. In teaching I have found it is mighty hard to induce students to study something they do not want, and they do not realize the importance of what you tell them until the year is over, when it is too late.

I have been well pleased with the remarks of Dr. Dewey. He has discussed the subject both from a practical standpoint and from a large practical experience.

Dr. Ray D. Robinson, Los Angeles. Dr. Dewey made one statement that I cannot allow to pass unchallenged; that is, when he said the reports of the State Boards throughout the country show that private schools were giving better instruction than the great universities. I want to challenge that statement. I know what the figures are; I have seen them. So far as the figures are concerned, he is right, but you know and I know that privately owned schools, whether small or large, are not giving the instruction that the great universities are giving.

Dr. Flint has just said that a young man goes to school for a certain purpose, and dental schools are organized for certain purposes. These big schools are organized to give instruction. A lot of these private schools are anxious to get their graduates to pass the State Board examinations, and their students are coached not to go out and practice dentistry efficiently, but they are coached to get by the State Boards.

Dr. Ottolengui,
New York City.

I ought not to take part in this discussion, but something was said that prompts me to do so.

I am glad to get in closer touch with Brother Brady. There are some university schools that are not beggars. I have made it my business to examine schools and see what they are doing. I have been very deeply impressed with what I saw in the University of Minnesota which has caused me to change my views on certain matters. I have contended that dentistry is not a specialty of medicine, and that all the teaching a dentist needs can be taught to him in a dental school, but I have to back water a little on that after visiting the University of Minnesota. I do not know where they get their money, but they have it, and as a result they have an enormous plant. Their pathological building alone is larger than most dental schools, and as a result they can carry on research investigations and teaching at the same time. But the most impressive thing there to me was this: they have also a hospital which was primarily intended for the use of medical teaching; but through Hartzell they found out that there is some relation between oral disease and systemic disease. They finally gave the dental investigators three or four beds and now they have three whole wards, one for men, one for women, and one for children, all of whom are referred to the dental ward when they have diseases which may be explainable by dental lesions. Little by little dental offices have been established, so that they can operate in a dental way on some of these people. There is no doubt in my mind that if you can get the same kind of teachers as you have in the privately owned schools and add to them the advantage of a big university equipment, you will certainly be able to turn out a better product.

I think that very largely the difference in the results shown in these university schools as to their graduates passing or not passing the State Boards, is based on the fact that the university schools have large classes.

For instance, a school sends six graduates to Illinois, and three of them fail, it is fifty per cent. failure. On the other hand, if six of them pass that State Board examination that is a hundred per cent. success. These kind of statistics are not comparable to a school that sends one hundred and fifty for examination. The more men you have to teach, the more unteachable men you will have to deal with. It seems to me, the ideal thing that must come some day and will come, is for the big universities to teach every special branch in a building specially devoted to the teaching of that branch, but with a study of co-related diseases, and with the equipment that a large university has without any stinginess in the matter of money.

Dr. Dewey is a little prejudiced in favor of the privately owned school. He knows what he is doing in his school, but he can look back to the days of the first proprietory schools in dentistry when the proprietors were out more for money than they were for producing a fine product. If Dr. Dewey should make a lot of money in his school, a number of other schools will spring up, for the money there is in it, and not for the product they expect to turn out. Just so long as he has a small school and has intensive study, it will be successful, but that does not prove that the privately owned school is correct.

Dr. W. C. Fisher. There is very little to add to what I have already said in my paper. Dr. Dewey misunderstood me in some respects or I did not make myself clear. I am not after the dental school to turn out a finished orthodontist any more than the medical school is expected to turn out a finished surgeon. It was not my idea to have the teaching of orthodontia incorporated in the dental curriculum; but graduates in dentistry should know more about orthodontia than they do to-day; then they will go to a post-graduate school.

Personally, I am not convinced that the dental departments of our large universities are turning out poorer material than private schools.

I referred to a two years' course only because of the fact that I want to see men take cases from the beginning to the end or until they see the finished product. I think we will all admit that in the most difficult cases, it takes two years for the man to see the results of a certain technique.

Again, we all lose sight of the poor chap in a small town of 5,000 or 20,000 inhabitants. I was thinking of big cities where we can hold these post-graduate courses. We have a post-graduate school of medicine in New York, where a man can study one week, two weeks, or study only two days. He pays for what he thinks he needs and leaves. I would like to see a school established where a man can stay long enough, if it has a certain definite curriculum, to receive a diploma. Still there may be many of you like myself who would like to go to a highly organized post-graduate school and spend two or three weeks and brush up on some particular feature of our work. That does not mean that we need to go through the entire course. The entire course would be for the man who has not been practicing orthodontia.

Again, Dr. Dewey speaks about the man who spends four years in a high school, and on top of that takes a dental course, and says that such a man will not take a course of two years more in order to practice a specialty. Well, I think even the medical colleges will have to cut down their preliminary education to get men out into the world sooner to earn a livelihood.

He says many of the students in colleges working their way through college have got to get out into practice early. The man who wants to acquire knowledge so badly that he works his way through college will also work his way through a post-graduate course. If you can get good, conscientious teachers, and this organization bears testimony to that fact, for an eight weeks' course in a private school, it seems to me you can get good teachers for a post-graduate course under university supervision.

The Results Observed in a Further Study of Prenatal Causes of Dentofacial Deformities.

By B. W. Weinberger, D.D.S., New York City, N. Y.

"Scientific thought is not an accompaniment or condition of human progress, but human progress itself."—(Clifford).

Karl Pearson (1) in his conclusion respecting the claims of science says, "For the present then, it is better to be content with the fraction of a right solution than to beguile ourselves with the whole of a wrong solution. The former is at least a step toward the truth, and shows us the direction in which other steps may be taken. The latter cannot be in entire accordance with our past or future experience and will therefore ultimately fail to satisfy the aesthetic judgment. Step by step that judgment, restless under the growth of positive knowledge, has discarded creed after creed, and philosophic system after philosophic system. Surely we might now be content to learn from the pages of history that only little by little, slowly line upon line, man, by the aid of organized observation and careful reasoning, can hope to reach knowledge of the truth; that science, in the broadest sense of the word, is the sole gateway to a knowledge which can harmonize with our past as well as with our possible future experience."

It is then only through scientific investigation that the traditions regarding the relative relation of the dental arches, occlusion and their perversions can give way to tested truths. In orthodontia some real progress has been revealed to obscure questions during the past few years; it matters little if some of the determinants have not yet been discovered, nor if from the limited experience of our observations we have failed to cover all the problems.

Last year in Pittsburg I had the pleasure of presenting before this society the results observed in my examination of embryos and foetuses. (2) and at that time showed that there are definite malformations as well as malrelation of the dental arches prior to and at birth, and enumerated a few of the probable factors that influence the development of the facial area.

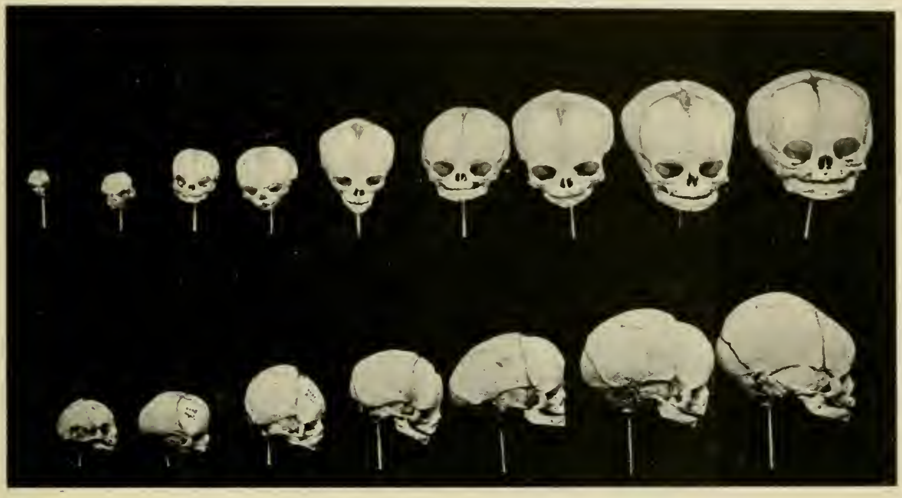

Fig. 1. Series of Embryonic skulls the end of the second month to the ninth month. Front and side view, illustrates the gradual growth of the skulls.

Unfortunately this paper was read just prior to the close of the meeting preventing a full discussion. For that reason I earnestly hope that this subject will be thoroughly discussed at this meeting as I consider the question of sufficient importance to again bring it before this Society. In case there is no discusson it will at least place before you some facts that might cause you to hesitate, and ponder before beginning the treatment of orthodontic cases.

At this time I will present further evidence to prove that we have conditions that are of prenatal origin, irrespective of what a few of you might care to accept, and that we have merely scratched the surface of the etiology of malrelation of the dental arches and malocclusion. While mechanics in orthodontia has its place. if we are scientific orthodontists we should and *must* give more attention to the etiological factors of the conditions which we are handling.

That this problem is a serious one has been fully proven during this past winter by men engaged in sister professions, especially those in pediatrics and infant feeding.

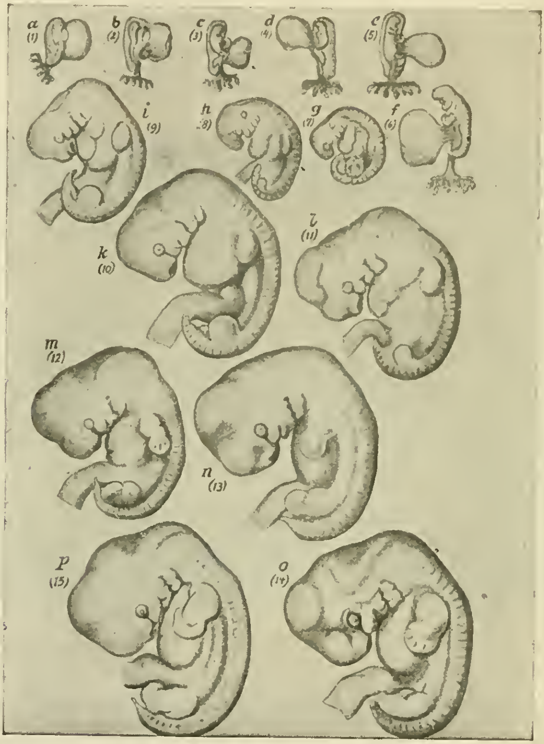

Fig. 2A.

Fig. 2. A and B. Development of the Human Embryo, showing the extreme coiling and gradual uncoiling of the embryo and fœtus. (His's Normentafel.)

As I endeavored to explain last year most of the material published so far in both the dental and medical text books concerning the "normal" skull at birth is inconsistent and contrary to careful observations; consequently misleading students and causing false conclusions. We have accepted these statements as true, neglecting to observe these things for ourselves, and thus we find we have been working from the wrong hypothesis and accomplishing little as far as "etiology" is concerned.

As the paper read last year was published in the November issue of Items of Interest you are undoubtedly acquainted with same. Nevertheless I will take the liberty of reviewing part of it.

The etiology of malformations depends either on internal causes or upon the action of external influences. Thus etiological conditions consequently depend upon one of the following three causes.

1st. Direct family heredity, not only from the parents, but from the ancestors as well.

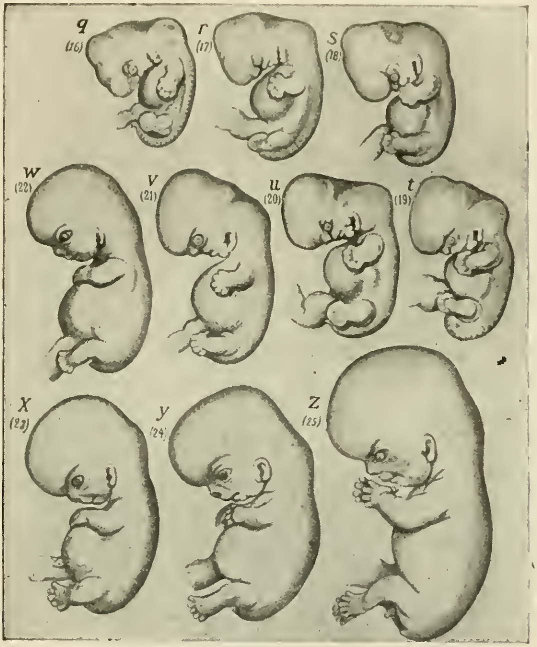

Fig. 2B.

2nd. Pathological. Not only disease, but all that pertains to it. Results are marked by irregularities.

3rd. Mechanical. Neither healthy nor pathologic.

"A malformation is generally defined as an alteration occuring during foetal development—i. e., a congenital alteration of one or more organs or systems of organs, or of the whole body, which does not come within the range of variation of the species." (3)

Nearly all malformations (embryonic and foetal) originate in the first six weeks of intra-uterine life or the embryonic period, and *"when the malformed embryo becomes a foetus, it carries whatever malformations it has into the foetal period, and is born with same."* (4)

Congenital malformation, therefore, is not always the product of late, but of early-uterine pathology.

Variations in the bones of the adult human skeleton are due to the chance persistence of transitory condition normally present in the embryonic or foetal skeleton and supposedly of phylogenetic importance. Studies show that the skeleton of the embryo is subject to fluctuating variations similar to those of the adult.

However, certain factors must be borne in mind as influencing the further growth and development of the individual. The form of the skeleton as a whole and of the individual bones which compose it may depend partly upon heredity, partly upon pathological, and partly upon the mechanical or chemical influence to which it is subjected during growth.

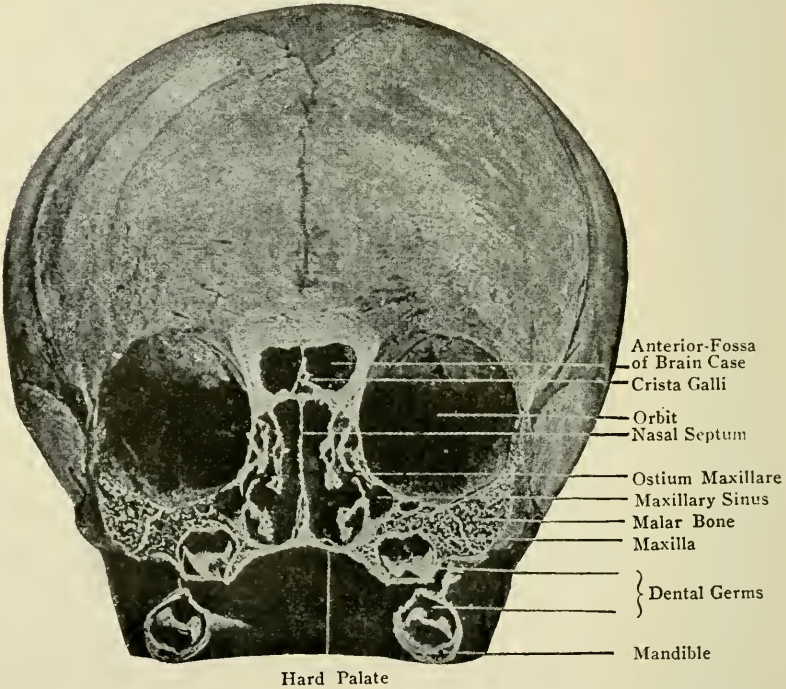

Fig. 3. Skull of a fully developed embryo cut vertically through the first deciduous molars, the orbit and nasal chambers. (Cryer.) This skull shows the mandible developed in advance of the maxilla. An abnormality.

Mendel's Views on Growth.

Mendel (5) in speaking of the factors which determine the possibility of growth says: "The factors which determine the possibility of growth, and upon which, therefore, any broad generalizations regarding the abnormalities of growth must be based may be classed, with respect to the organism involved, as internal or external in character.

The internal factors include the real impulse to grow, of whatever nature it may be; in part they are inherited, they belong to the permanent biological characteristics of the individual. Heredity, with all that it involves, determines the most potent of these internal, constitutional incentives and conditions of growth. These are the determinants which are largely beyond our immediate control, yet must be reckoned with when defects of growth appear. The external factors that modify growth, on the other hand, are more amenable to directive regulation. The environment of the individual can be modified more or less at will."

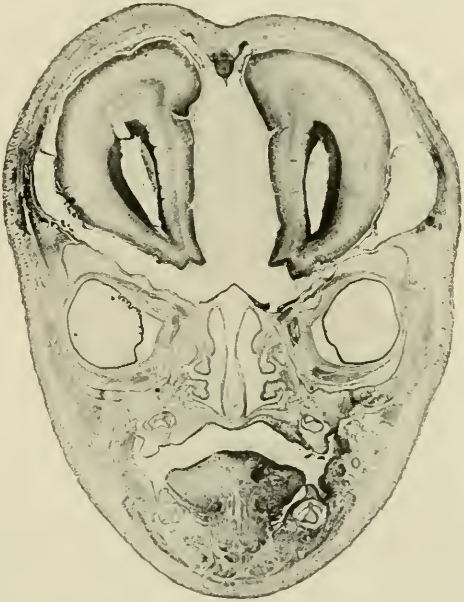

Fig. 4. Frozen section of a skull, cut vertically. Here we find the same relation between the mandible and maxilla as in adult life.

"In order to have a common basis for the discussion of the abnormalities of growth some definition is essential, difficult though it may be to formulate one in entirely satisfactory terms. Even when the body as a whole no longer gains in size, individual parts like the hairs and nails may continue to grow. It will be preferable to speak of such phenomena of localized growth as a renewal of tissues, and likewise—to exclude from the category of real growth the deposition of fat and other reserve materials that often produce a gain in weight. "Increment in size" or "gain in weight" or "enlargement of mass" are inadequate descriptions of the more specific characteristics of the growth of the higher forms. I have found no more helpful concise definition than that by Schloss (6) who characterizes growth as "the correlated increase in the mass of the body, in definite intervals of time, and in a way characteristic of the species."

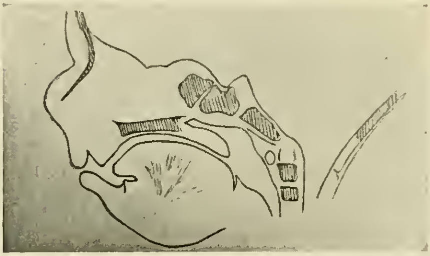

Fig. 5. Mesial section through base of cranium and face of normal fœtus. (Kaufmann.) (From Jansen.)

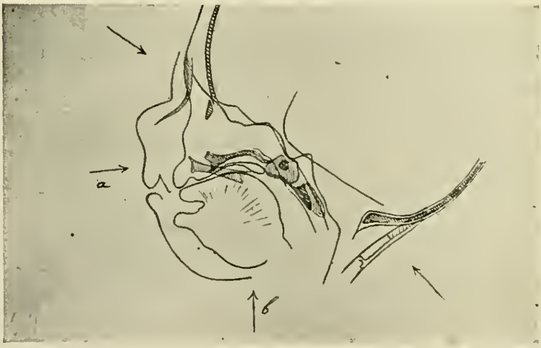

Fig. 6. Kaufmann's fœtus VI laid together with the normal Fig. 5. Pressure during fœtal life has acted in the direction of the arrows a and b. Light lines are normal, dark abnormal. The hard palate is displaced backwards and bent.

"Perfect growth and development implies a far-reaching correlation of the various parts of the body. An upset in this nicely balanced relationship is speedily recognized as an anomaly. Energy and matter are sufficient to explain the consummation and maintenance of a normal as contrasted with an abnormal composition of the cells. The specificity of growth is something marked, particularly when normal is contrasted with perverted growth. The definition referred to above has a particular value in the analysis of abnormalities of growth because it immediately suggests some of the anomalies of irregularities. Abnormal growth may involve (1) the correlation feature, or (2) a time factor whereby the characteristic rate of the increase in mass is not maintained. The correlation refers, for example, to the arrangement of matter in respect to composition and likewise to form. When there is overgrowth of one part or undervelopment of another the correlation is upset. This is abnormality. Likewise when the change in size is well proportioned or correlated, but unduly delayed or prolonged, growth becomes abnormal in its rate for the individual under consideration." (5)

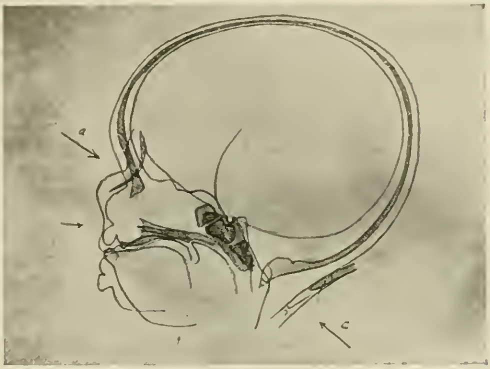

Fig. 7. Base of the cranium of Kaufmann's fœtus 1 laid together with the normal (light lines) mandible pushed forward. Pressure here is in the direction of the arrows a and c.

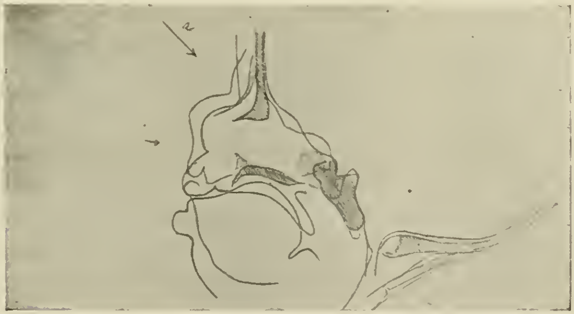

Fig. 8. A similar condition. Direction of the arrows a and c.

Fig. 1 shows a series of human embryonic skulls from the second month to the ninth month, front and side views, and illustrates the gradual growth of the skull. The relative small size of the maxilla is a cause of the small dimensions of the foetal face, but at birth the maxillary sinus, which is only a slight depression on the medial surface, extends laterally into the maxilla and gradually enlarges until dentition is complete. As this maxillary sinus increases in size, the alveolar process develops and with the development of the teeth, brings about the growth of the maxilla, mandible and the corresponding parts of the face.

Fig. 2 shows the extensive coiling toward the ventral surface with the gradual uncoiling. First the trunk straightens out and the nape bend slowly becomes obliterated. This is accomplished by a rapid growth of the ventrally situated organs, especially the heart. With the straightening out of the nape bend opportunity is offered for the formation of the neck.

The evolution of the face must depend upon the enlargement and fusion of the oral and nasal cavities, upon the partial separation of those cavities; leaving the posterior nares open, and upon the growth and specialization of the facial region of which the development and elongation of the maxilla and mandible is the most conspicuous indication. While this is occuring there is a modification of the position of the face in relation to the brain, cranium, and heart. As the oral region develops the extensive coiling of the embryo begins to straighten out and the heart's position descends.

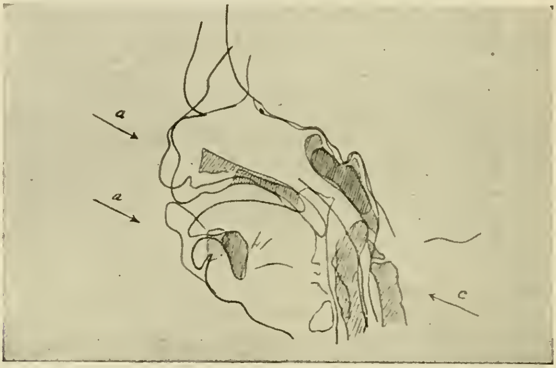

Fig. 9. Outline of a frozen section of a normal (light lines) and abnormal fœtal skull. Pressure here has been in the direction of the arrows a and c. The base of the cranium is shortened, and the mandible displaced backwards, as well as the hard palate.

Here I desire to bring to your attention a skull Dr. Cryer showed last year and is to be found in his second edition of the *Internal Anatomy of the Face,* which I believe to be an abnormality and not a "normal transverse section of a child's head at birth."

Fig. 3 is the skull of a fully developed embryo cut vertically through the first deciduous molars. Dr. Cryer in describing this skull says "the lower jaw is developed slightly in advance of the upper"........... "if a vertical line is drawn through the center of the tooth germs and the alveolar process of each jaw, it will be found that the lines of the upper jaw are on the inner side of those of the upper, the difference being one-half the thickness of the lower jaw," .... "as the teeth erupt, the lower acts as a matrix upon which the upper is formed and we find the upper teeth one-half a tooth buccally over those of the lower." (7)

In examining a half-dozen dissections of frozen foetal skulls I have failed to find one case where the mandible was developed in advance of the maxilla, but on the contrary all show this development to be the same as in adult life. Fig. 4. (Foetal skull.)

I firmly believe that the skull Dr. Cryer showed is an abnormality and it only strengthens my previous conclusions that we have abnormalities to contend with prior to birth.

AMNION-PRESSURE IS ABLE TO CAUSE:		The mechanical malformations are attended by phenomena of stunting in growth of even of destruction.	During the development of these disturbances the skeleton is in the stage of the:
	mechanical malformations of the embryo:		
during the 1st and 2nd weeks	a wrinkling of the embryonic axis.	destruction of ecto- and mesodermal elements (anencephaly).	mesoderm, 1st stage.
during the 3rd — the ± 6th week	infolding of the embryonic axis.	stunting in growth (achondroplasia).	scleroblastema, 2nd stage.
during the ± 6th — the ± 8th week	Compression or curving of the extremities. (The embryonic axis remains intact.)	kakomelia in which bones are lacking (hemi-ectromelia, oligodactyly and others).	scleroblastema of the extremities, cartilage and bone of trunk ↗
after the ± 8th week		kakomelia with the normal number of bones (club-foot).	↘ cartilage and bone of the extremities, 3rd stage.

Fig. 10. Table illustrating what amnion pressure is able to cause. (Jansen.)

Mechanical Factors in Foetal Life.

Having observed malrelation of the dental arches as early as the fourth month of foetal life it will be necessary to consider the factors affecting early malrelations. At the Pittsburg meeting I dwelt at some length upon the third cause, namely, mechanical, i. e., amnion pressure. This I will review briefly. Of all the known causes, the pressure exercised by the uterus and the foetal membrane as a result of a deficency in the amount of liquor amnii is undoubtedly the most significant. The damage caused by this condition manifests itself mainly in the extremities and according to the view of Jansen (8) and others, anomalies of the amnion play the most important part in the early production of malformations, and are to-day considered of the greatest importance.

As stated, then, it is during the germ cell period that the first rudiments of the individual is laid down. Surrounding the embryo and within the outer surface is found the liquor amnii varying considerably in amount.

The study of the mechanical malformation show that the normal head bend of the foetus is accentuated by external forces or pressure; that pressure on the head curve must push the region of the branchial arches and the future face against the organs of the chest and chest wall, causing the floor of the mouth to approach the roof of the primitive bucco-pharyngeal cavity. From this we can readily see that there is hardly any part of the infolded embryo that is more exposed to the dangers of increased pressure than that in which the branchial arches are squeezed against the chest wall. This pressure interferes with the blood supply, causing a disturbance in circulation, a temporary disturbance in nutrition, and a stunting of growth of the part affected.

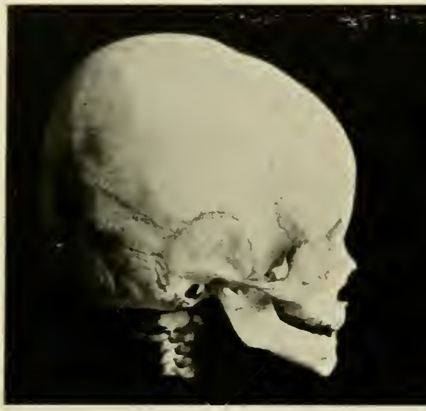

Fig. 11.

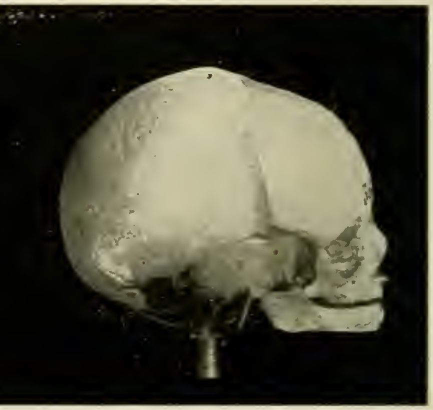

Fig. 12.

Fig. 11. Normal skull of infant of six months. Note relation of maxilla and mandible. (Wistar Institute.)

Fig. 12. Normal relation of the mandible at birth. (Army Medical Museum.)

The following figures from the above work clearly illustrate the theory of amnion-pressure. Fig. 5. "Mesial section through basis cranii and face of normal fœtus." (Kaufmann), the outline of which is placed parallel to the mesial sections of Figs. 6-9. In Fig. 6 we find that mechanical pressure has acted upon the face in the direction of the arrow (a) which has pressed both the nose and the hard palate backward. The parts of the mouth have been squeezed between the base of the skull behind and some compressive influence in front. This pressure has also changed the direction of the palate, its posterior position has been tilted upwards, so that the angle which it forms with the basis cranii, has been made greater than normal, indicating that under the chin a similar mechanical pressure has been at work, in the direction of the arrow (b)." The very same phenomena are visible in Figs. 7-9. "The sagittal dimensions of the mouth cavity are reduced; moreover the profile line of the lower jaw appears to be pushed inward, showing that an abnormal pressure against the jaws has acted in a backward direction."

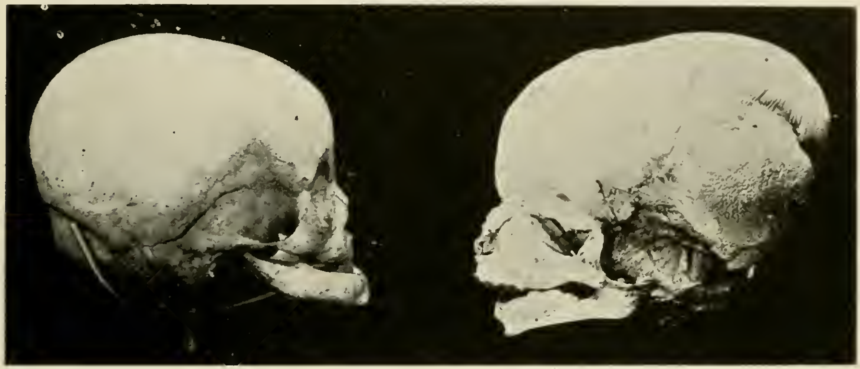

Fig. 13. Fig. 14.

Figs. 13-14-15. Series illustrating a marked disturbance in development at birth.

The following table admits of a survey of the above facts. Fig. 10.

Mechanical malformations effected by amnion pressure is characterized by two groups of phenomena, interference with growth and mechanical malformations. Thus we find the region of the dental arches can be either partly or wholly compressed mechanically and the hard palate displaced in the direction of the base of the skull.

Having observed the effects of mechanical pressure on the face let us now consider a "normal" skull. Fig. 11 is the skull of an infant of six months. The deciduous central incisors have erupted and are in occlusion. The position of the mandible is normal.

Fig. 12 shows the normal relation at birth while Figs. 13-14-15 show a few of the variations found at that age.

That we have abnormal relations of the dental arches at or prior to birth can no longer be a disputed question, with a consequent malocclusion of the deciduous teeth.

Now what does the examination of these illustrations reveal upon close inspection? Dr. Hellman reported some years ago "that a great majority of our cases are bottle fed children and that malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast feeding." (9) The result of my investigation only strengthens his contentions and prove that we must go even further back than this, for bottle feeding is only the result and not a direct cause. A great majority of our patients were "raised on the bottle," but why?

During development the skeleton is markedly influenced by internal chemical conditions, internal secretions, affecting growth or general nutrition of the body and in some cases seems to be the part primarily affected. This is the next great step in orthodontia that must be investigated and one we will undoubtedly have to undertake ourselves.

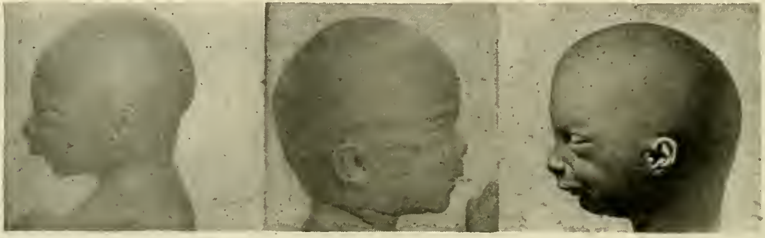

Fig. 15.

McCrudden's Views on Bone Development.

Defective bone growth is undoubtedly concerned in a variety of abnormalities of development. A quotation from McCrudden (10) may serve to illustrate some of the problems involved:—"Another kind of condition in which bone growth is involved is dwarfism. The causes are probably many. But in one type I have observed a disturbance of calcium metabolism associated with improper development of bone. Calcium is almost absent from the urine, leading to the belief that the blood must be poor in calcium or contain it in some unusual combination. The feces are very rich in calcium, containing sometimes more than the food. There is, in fact, a flux of calcium through the feces. And in these cases the long bones fracture easily and Roentgen ray examination shows a very thin cortex. In other types there are no abnormalities of this kind. Now, as pointed out by Rubner, (11) we can imagine two fundamental causes for the lack of growth: (1) the lack of what might be called the tendency to grow, that property which is present in young animals, but absent in adults, and (2) the absence of the material for growth. And it seems to me that in these two types we have examples of disturbances of each of these two factors. In the one the skeleton is growing as fast as the material at its command permits. We might also say that it is growing too fast, for it is growing in length at the expense of solidity. In the other there is no such tendency to grow. There is calcium enough present to form longer bones, but there is no tendency to form them. And this kind of disturbance of bone nutrition we may refer to as a quantitative change, for the bones fail to grow in size. There are two large subdivisions of this type........ one in which the tendency to grow is absent, the other in which the material for growth is not available."

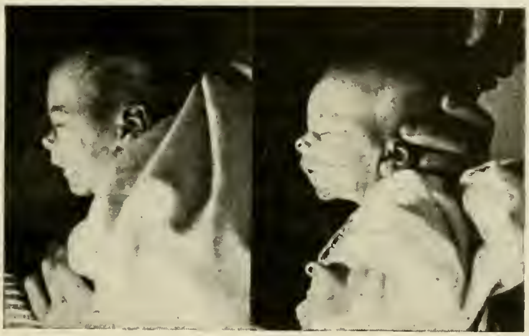

Fig. 16. In both these cases it was not on account of the mother's inability to secrete milk or nurse her offspring that compelled the use of the bottle, but due entirely to the distocclusion of the mandible.

Mendel's Views on Growth of Bone.

Mendel then states, (12) "There is occasion to believe that the growth of bone in the young is only one of the developmental processes under the physiological dominance, so to speak, of the endocrine or ductless glands. The thyroid, thymus, ovary, testis, hypophysis and others, furnishing inhibitory as well as facilitating factors, may be involved. The effects of removal or loss of function of some of these glands upon growth are being investigated in a more systematic manner."

"It will be noted that the interferences with normal growth may be constitutional, or internal, in some of these manifestations of abnormalities of correlation, and external or seemingly associated with alimentation in other cases. It is not yet possible to distinguish clearly between cause and effect."

"It is too early to draw any sweeping conclusions from the already extensive literature on the ductless glands; but one may look forward with confidence to interesting developments in this field of the physiology and pathology of growth. Future investigation may show that directive influences in growth reside in the endocrine glands to an extent scarcely realized at present; possibly it will be found that the correlative factor which has been emphasized in this review is closely bound up even more closely than can now be appreciated with the proper growth and development of such special tissues."

Williams' Views on Thyroid Secretion.

Recently Dr. Kirk (13) in a paper entitled, *Malocclusion as a Problem in Pathology,* quoted from Williams, saying "That the thyroid secretion is essential to the development of the foetus is shown by several facts........It is normal for women during pregnancy to develop an enlargement of the thyroid gland, which subsides rapidly after the child is born. By no means the least important function of the thyroid gland is that of fixing the calcium salts in the body. In order to permit of bone formation in the foetus, the mother is obliged to provide more secretion than under normal circumstances she requires, and the gland consequently hypertrophies. After the birth of the child the increment being no longer necessary, the gland resumes its usual proportions. *In some women this prolonged call of pregnancy has the effect of unduly exhausting the gland, and they are unable in consequence to suckle the child, for loctation is dependent upon a due supply of thyroid secretion.* Such women generally become obese and lethargic, and remain so for varying periods until the thyroid has had time to recover itself. Judicious thyroid medication will frequently not only enable a mother to suckle her infant, but will materially shorten the period of her post-partum difficulties."

"Now with regard to rickets I feel in a position positively to affirm that if all the symptoms of the disease are not due to thyroid insufficiency, then certainly its most salient features are. Especially does this apply to the bony phenomena which characterize its outward seeming. These phenomena are obviously due to inadequate osseous development, and as in the foetus so in the growing infant, thyroid secretion is essential to the full utilization of the calcium salts. It is known that the bony phenomena are due to a relative absence of calcium salts, and it is also known that these salts, given in large excess though they be, have no influence in arresting the disease. This is because the all-essential link is missing, the thyroid secretion, by whose means alone the ingested calcium can be so assimilated as to be incorporated in the osseous tissues. I claim no originality for this view as to the essential factor in rickets. It was first advanced by Professor Marfan in 1907, and upheld in an interesting paper which does not appear to have attracted the attention which it deserves. My own experiences have convinced me that this view is correct. If it be true anywhere, as the adage has it, that

Naturam morborum curationes ostendunt, it is pre-eminently true in the sphere of opotherapy, and every case of rickets in which I have employed thyroid extract has shown such decided improvement as to leave no doubt in my mind that thyroid insufficiency is the main causative factor in the disease."

"As a child progresses in years deficiency in thyroid secretion may reveal itself in various ways." ......"In the same connection I discussed the question of adenoids, and made so bold as to suggest, concerning them, that they constitute one of the stigmata of thyroid insufficiency."

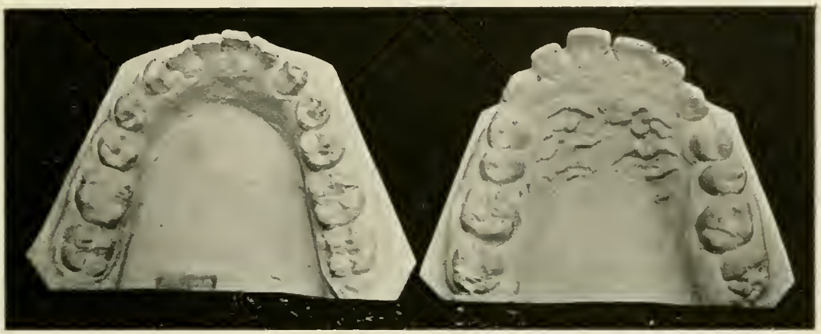

Fig. 17. Overdevelopment of maxilla and mandible with marked spaces between the cuspids, premolars and molars.

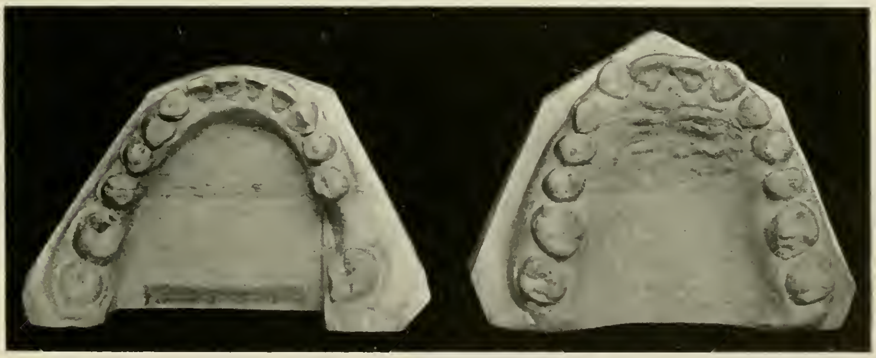

Fig. 18. Similar to Fig. 17 with spacing between all of the teeth, upper laterals missing, both deciduous and permanent cuspids present.

"Adenoids and enlarged tonsils occur in children who have an inadequate supply of thyroid secretion. The hypertrophic condition in each case is apparently the result of an endeavor on the part of the organism to supply an internal secretion as nearly allied as possible to the one which is lacking. If the hypertrophy is not very pronounced, and if it has not been very long in existence...... great enough and protracted enough, that is, to produce complications such as disease in the tonsils themselves or in the ears........ then the exhibition of thyroid extract will cause their regression. It is only when medical means have failed that operative interferences becomes justifiable." This certainly confirms the conclusion of McCrudden and Mendel.

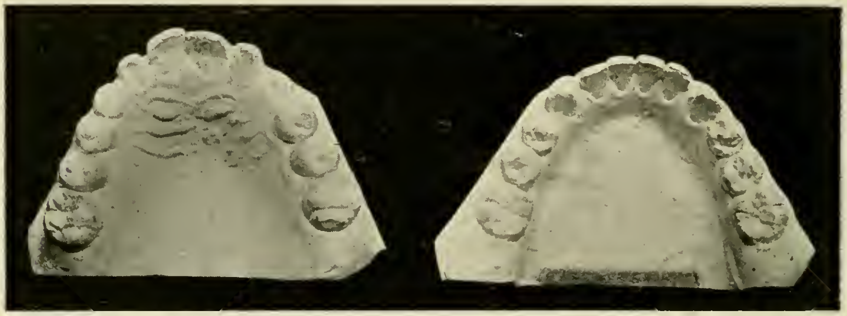

Fig. 19. Overdeveloped maxilla and mandible.

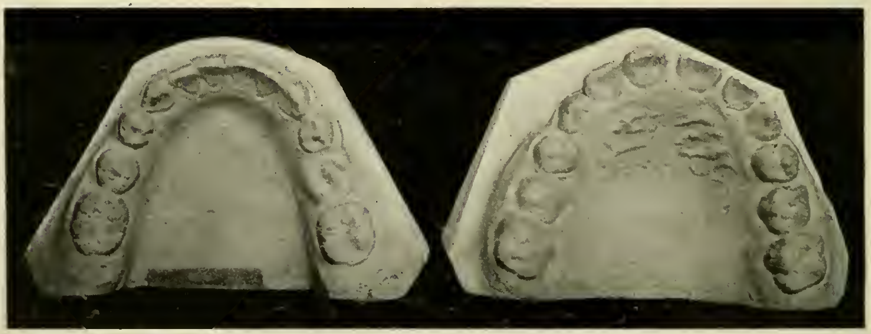

Fig. 20. Increased bone growth in both dental arches.

Bottle Feeding. Hellman's Views.

As to bottle feeding being the cause of malocclusion of the teeth Hellman later modified his previous conclusion by stating, "Malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast feeding." ...."It may therefore be concluded that of the numerous factors that enter into the etiological problem of malocclusion of the teeth, *internal secretions* is the one which may in a large measure account for many mysteries that perplex the orthodontist." (14) In discussing Kirk's paper this same investigator states, (15) "Some years ago I began the study of the etiology of malocclusion. I started, as Dr. Kirk said, from the viewpoint of orthodontia. This was done by making the nipple of the bottle-fed baby the bone of contention, but after I had pursued this study for awhile, the subject broadened out beyond the nipple, and beyond orthodontia, extending into medicine, and probably into biology. So that the fact of the matter as it stands to-day is exactly as stated by Dr. Kirk. By experimentation it was found that insufficient thyroid secretion is the cause of disturbances in lactation. This has been proven over and over again by clinical observation also. On account of the inability of the mother to secrete milk and nurse her offspring, most of these children have to resort for their maintenance to the bottle."

Bottle Feeding Due to Malrelation of Jaws.

We thus find here one of the reasons for the great percentage of "bottle fed babies." There is one factor however we all have overlooked which I believe must be seriously considered before holding the mother entirely accountable in all cases for this condition. This winter I have endeavored to observe in various institutions the relation of feeding to malrelaton of the dental arches and have discovered a fair percentage of infants unable to nurse, not on account of the condition of the mother's inability to secrete milk, or to nurse her offspring, but where the infant was compelled to resort to the bottle to obtain nourishment owing to the malrelation of the mandible preventing proper breast feeding. Fig. 16. See also Figs. 13-15. Whichever of the underlying causes it may be, each has the same deep common origin.

Influence of Ductless Glands on Dentition.

Falta in his *Ductless Glandular Diseases* (16) shows that the endocrine organs have a direct bearing on the oral cavity and the teeth, we are now only beginning to realize to what extent. He states, "Disturbances in dentition go hand-in-hand with those of growth of the bones. When the thyroid gland is entirely absent the children during the first year remain completely toothless. In the latter years the milk-teeth develop very slowly and finally remain partially retained. (Often in addition to the retained milk-teeth are found the rudiments of the permanent teeth.) Here thyroid therapy, as we shall see later, may elicit excellent results.

"Of quite a manifold nature are the findings as to the teeth of cretins. Kranz examined thirty cretins from the Knittlefeld Institute in Steiermark as to jaw and tooth formation, and found numerous anomalies of the jaws, retarded teething, and factors giving rise to anomalies of the position of the teeth. Further he commonly found alteration of the

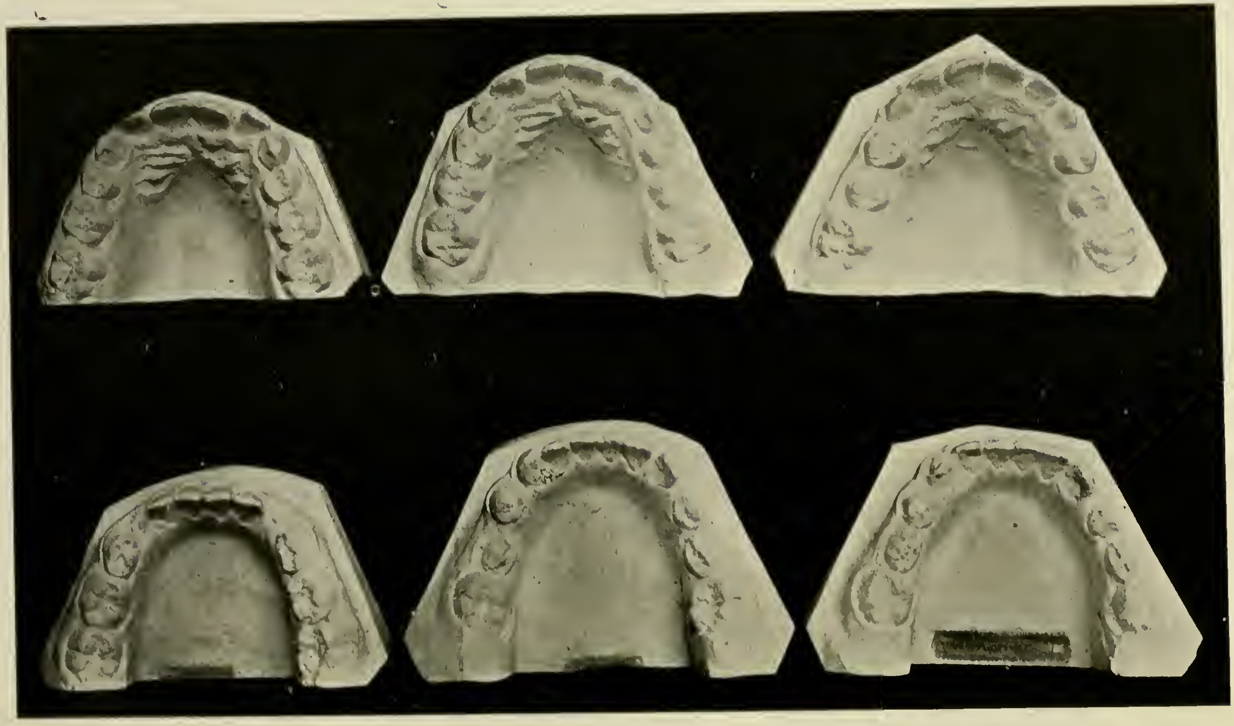

Fig. 21. Progressive case. Same case age 10, 13 and 14 years, showing increase of bone growth and spacings between the teeth. Peculiar undersized shaped premolars.

structure, defects of the enamel, hypoplasias and erosions and very frequently caries.

"Of recent date are the investigations concerning the disturbances in tooth formation. Erdheim first observed that this occurred in rats. One and one-half to two and one-half months after the operation opaque spots on the anterior surface of the incisor teeth which gradually advanced toward the points with the teeth's growth.

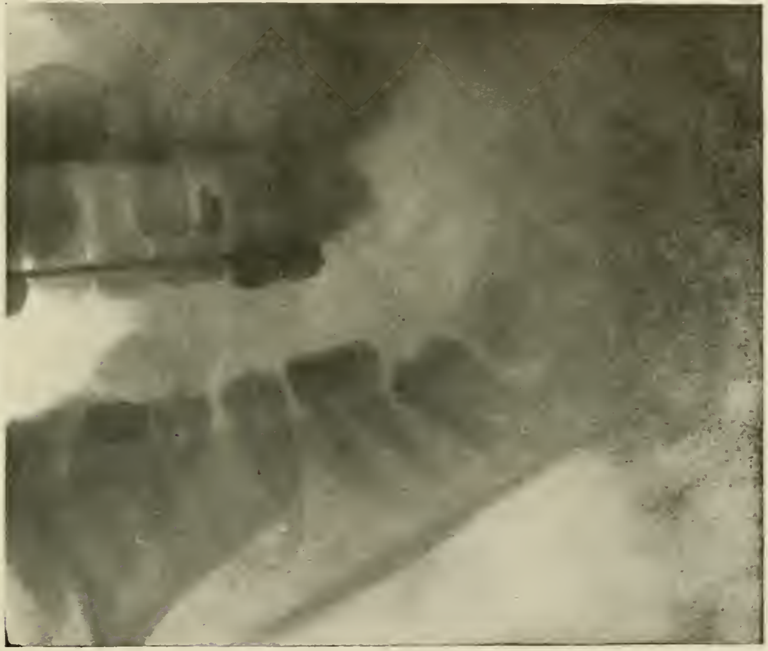

Fig. 22. Delayed eruption of upper second premolar, 14 years old, due to unequal absorption of the deciduous roots. These delayed dentitions can, in nearly every case, be traced to the same cause. This also shows the increased bone growth in the mandible.

"Erdheim observed a deficient calcification of the dentin. Even the short cessation of parathyroid function that occurs in auto-transplantation of the parathyroid is sufficient to determine the appearance of stripes poor in calcium in the dentin of young rats. A special clinical interest to Erdheim's studies is given by the investigations of Fleischmann. This worker held the view that the defect of enamel so commonly observed was due, not as was formerly supposed, to rachitis, but to tetany. He points to the disproportion between the frequency of rachitis and hypoplasia of the enamel. In rachitis are regularly found alterations in the dentin; in tetany, however, one always finds hypoplasia of the enamel leading to the formation of horizontal transverse surfaces. When frequent exacerbations of the tetany have occurred, are found numerous furrows below one another. Fleischmann investigated ten children who had suffered from tetany and found in all the above-mentioned hypoplasia, and indeed this was present only on those teeth that had been present during the course of the illness. Nearly all of the children have also had rachitis. Fleischmann points out, however, that rachitis lasts much longer than tetany, and also attains its acme much later. Fleischmann also finds support for his view in the statement of Fuchs that children with lamellar cataract almost always show hypoplasia of the enamel. In individuals with hypoplasia of the enamel, in whom nothing is known of their having had tetany, there may have existed a latent tetanic condition in early childhood. Very convincing is an observation of Spiegler in a case of recurring tetany who had an attack every spring during eight years. In this case it was known that the tetany had first made its appearance at the end of the second year of life. All teeth whose crowns must have been formed at this time were normal while the teeth whose crowns developed later showed defects of the enamel. An entirely similar case was observed by Kahn and myself (Observation XXIII). Here were found on the canine and incisor teeth punctiform defects of enamel often arranged in parallel rows; the upper parts of the molars were partly broken off.

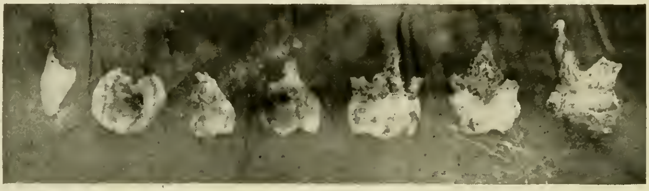

Fig. 23. A series showing teeth that had to be extracted owing to unequal absorption of the roots.

"The connection between tetany and defects of the enamel is by all this evidence put on a sound basis; and I shall not discuss the possibility of these defects being brought about by other causes."

The details of the following few cases I will leave for some other paper. In order to bring home to you all this question of internal secretion and its effect on malocclusion of the teeth and to enable you to observe these facts for yourself I will show you a number of cases from my own practice. I trust all will in the future observe these facts and record them, so that we may arrive at some definite conclusion. Without the help of everyone, those interested in this work will be handicapped, and unable to make much progress.

Case 1. Both the mandible and maxilla are overdeveloped, with marked spaces between the cuspids, premolars and molars. Female, age fifteen. Fig. 17.

Case 2. Similar condition. Missing upper laterals. Upper and lower deciduous cuspids retained. All permanent cuspids present. Female, age twenty-five. Two sisters show the exact conditions. Brother normal. Fig. 18.

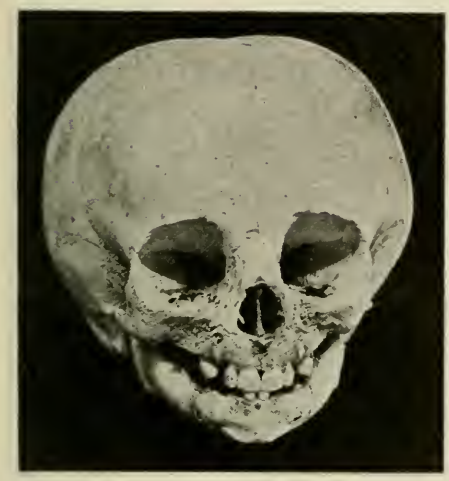

Fig. 24.

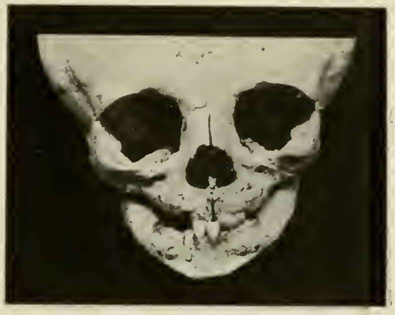

Fig. 25.

Fig. 24. Skull of infant nine months of age, showing great irregularity in the order of development of teeth, the upper having erupted in advance of lower.

Fig. 25. Skull of infant about eight months old. Protruding mandible, median line shifted. Upper left and lower right erupted prior to the right and left sides. Richitic children.

Case 3. Increased spacing between all the upper teeth including deciduous molars. Spacing between lower premolars. Female, age thirteen. Fig. 19.

Case 4. Increase of bone growth in mandible between cuspids and premolars. Female, age eleven. Fig. 20.

Case 5. Same case, three years and one year apart. Gradual increase of both the maxilla and mandible. Peculiar shaped lower premolars, upper extremely small, occupying half of the space of the deciduous molars. Female, ten, thirteen and fourteen years. Fig. 21. Delayed dentition due to unequal absorption of the deciduous molars, thereby preventing the tooth from falling out. Fig. 22. Fig. 23, a series showing teeth that had to be extracted as they were unduly retained in place owing to unequal absorption of the roots. The one on the extreme right is shown in Fig. 22.

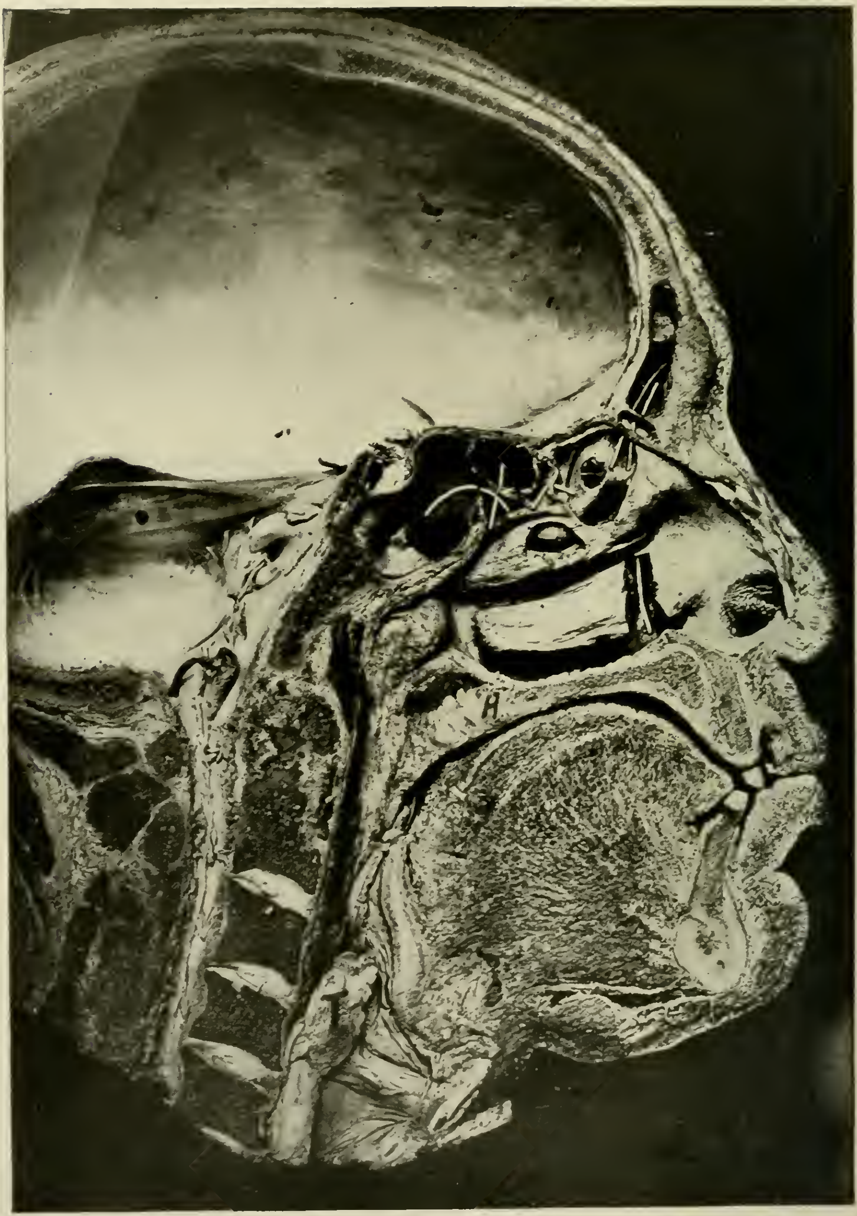

Fig. 26. Frozen lateral section of skull, showing (A) adenoids and (T) tonsils.

Summary.

Every case shows an increase of bone growth in the premolar region, with the exception of case 5; all present an early permanent dentition. Another peculiar fact is that all cases so far observed are in females, with the increase of development taking place at puberty. This is undoubtedly due to sexual conditions, as the period of adolescence was reached in every case earlier than in the average girl. We thus find a peculiar association between mandibular and maxillary growth, age, puberty and sex. A more striking factor and the one that is of the most interest to us is that this abnormal condition showed itself first through the teeth, and upon a thorough investigation established the fact that in all of the above cases one or more of the ductless glands were found to be secreting abnormally. Figs. 24, 25 are two skulls of infants about nine months old illustrating a great irregularity in the order of development of teeth. Associated with this irregularity is an abnormal relation of the dental arches. Both skulls show that rickets had been present, and from what has already been described we know that this disease is now closely associated with the ductless gland.

This illustrates how closely related the teeth are to the other structures of the body and emphasizes the fact that greater co-operation between the orthodontist and the medical profession is necessary if we are to obtain results.

Influence of Adenoids and Tonsils.

Before concluding I desire to bring to your attention the question of adenoids and tonsils. Here again I believe we are being misled as well as misleading others, by accepting the theory that adenoids and tonsils cause malocclusion and malrelation of the dental arches. We have not studied this question thoroughly enough and have been led blindly into making the above statement. Have we not put the "cart before the horse"? By examining Fig. 26, we see that if the mandible is in distal occlusion the tongue must be pushed upward and backward into the posterior part of the oral cavity thus causing an abnormal pressure in that region especially against the adenoids and tonsils. These organs having already hypertrophied through congenital constitutional causes are increased in size. Whatever the constitutional cause is that brings about the distal or mesial occlusion of the mandible, no doubt, also produces a pathological condition of the adenoids and tonsils, therefore, mesial, distal, or malocclusion of the teeth is *not* the result of adenoids and tonsils. Let us once and for all lay aside such unscientific statements and make up our minds that orthodontia is nine parts scientific and one part mechanical. When we do this we will place our profession where it belongs.

Conclusions. 1. Both dental and medical text books concerning the dental arch at birth are at present misleading students and are contrary to careful observations.

2. We have malrelation of the dental arches, malformations and conditions to contend with prior to birth, varying in a marked degree. Thus we find malocclusion in the deciduous teeth.

3. A great many early abnormal conditions, will undoubtedly, be found to be the result of mechanical disturbances, the results of amnion pressure.

4. During development the skeleton is markedly influenced by internal secretions, affecting growth or general nutrition of the body, tongue, jaws and the teeth.

5. In orthodontia we have the question of internal secretions to contend with and a greater co-operation between the orthodontist and the medical profession is now necessary if we are to obtain results.

6. Adenoids and tonsils do not cause malocclusion of the teeth, but both are the result, undoubtedly, of the same common etiological factor.

Therefore, as orthodontists, let us lay aside the idea of our science being nine-tenths mechanical and begin to solve these intricate problems taking place during ontogenetic development. When we do this we will place our specialty among the foremost of sciences.

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Discussion on the Paper of Dr. Weinberger.

Dr. W. J. Brady,
Kansas City, Mo.

This question has been before the dental profession, especially the orthodontists, ever since I can remember, and all overlook one vital point, and that is, that no matter what the condition is, unless it be such an absolute deformity as cleft palate or absence of the lower jaw, or some such malformation that is unmistakable, the bones of the face will not remain in the condition in which they are at the time of birth, longer than a few weeks. Nature has her own plan of bringing these bones to their full growth, and it is well that is so, because the human being may start out in life with the bones of the face very much misshapend. If we were to examine case after case, we would find that it is the rule not the exception, yet they manage to reach a reasonable degree of maturity, a reasonable degree of sameness, through the treatment which we advise. Why? Nature has made her plans whereby these seemingly malformed cases may be straightened out, and in this we must not overlook an important thing, that is, the effect of use upon the jaws in their development.

Bone and Face
Development.

Most malformations do not begin to develop until the temporary teeth are in place and there begins to be a considerable usage of these teeth; I do not say all, but the majority of those that we meet with in daily practice. They do not begin to develop until there are some teeth present. The bones of the face have their rules of development apart from other bones. Other bones follow laws of development apart from still others. The brain gives proper development according to the growth of the brain. We used to think that in some ways the brain did not develop as it should, and therefore, the brain was restricted, but it is the other way. In case there is no brain tissue developed, the cranium does not develop. In the case of the bones of the face, that which develops them is use, and if that use is given as Nature intended, the stimulation of pressure upon the bones from the use of the teeth develops them almost to normal. We get a wrong view of these things at times. We imagine that the general run of the population have malocclusion, but the fact of the matter is that there is only a small proportion of the population of our country that have any great degree of malocclusion. If you go around among the schools, among the people where there are different classes, you begin to open your eyes if you are not so prejudiced that you will not see these things. I can see things outside the walls of my office, and I have discovered there is no such malocclusion as I had supposed there was. In the reform schools, where we get the product of the dregs of the community, there we supposed we would find every sort of trouble in the way of malocclusion that could be found, and yet, to my great astonishment, when I have investigated cases of that kind I found they had the finest types of dental arches and malocclusion was the great exception. So we do not find cases of malocclusion as frequently as we have been prone to believe, and it is because Nature manages through her processes to bring about normal development of the bones of the face a great deal oftener than we think.

Causes of Malocclusion.

Now, in malocclusion there are two causes that stand out above all others, and they comprise fully ninety per cent. of all malocclusions encountered, anywhere, and at any time. The first fifty per cent. of this ninety is caused by adenoids and bad tonsils. In spite of our friend's belief, this particular form of malocclusion is not found except the adenoids are there first. We have been mistaking a symptom for the cause. It is exactly the other way. Malocclusion is not the cause of anything; it is the product of something, and bad tonsils and adenoids are the cause of fully fifty per cent. of the cases encountered. The other forty per cent. are caused by disuse, meaning a lack of usage of the jaws and associated tissue. We have learned that through the force of circumstances certain people are compelled to use their teeth; that their jaws develop to the full size; that the dental arches assume normal forms, and that there is no need for orthodontists in that country. If you go to the museums and see and examine the skulls from various parts of the world, and notice the character of food on which these people lived, you will find among those that came from the North, the Eskimos, who lived on food uncooked, and where they chewed it thoroughly, their jaws developed to accomodate the teeth and malocclusion is comparatively unknown. If you examine the skulls that come from the Southwest among the American Indians, you will find they lived on jerked beef and corn and perhaps raw bones, and the Indian boys and girls took away these bones from the dogs to get them to gnaw; but their jaws were well developed and of full size. The jaws grow and develop by usage. Usage is an immense factor in the development of the jaws, and it is the factor that brings about the great number of full developments or practically normal developments of the jaws in this country which we do not realize are in existence because we do not see them.

Dr. B. W. Weinberger (closing.) I appreciate what Dr. Brady has said and the spirit in which he has given it, but I cannot look at this from his standpoint. We have malformation prior to birth; this fact cannot be disputed any longer. To say that science does not recognize prenatal influences is assuming too much. The sooner all of us realize this, just that much nearer will we be to our goal. How large a percentage of abnormalities we have at that age no one knows. In going through the hospitals in New York, out of hundreds there were not more than a dozen well defined cases, so that the percentage is small, but we have definite malformations at birth.

There is no doubt that prenatal influences are having a peculiar effect and it is being investigated by men connected with diseases of children, infant feeding and so on. These men have tried to determine why children must be taken off the breast and put on the bottle. As explained in my paper there are infants, who could not nurse from the breast, due to the distal relation of the mandible, so there must be something back of prenatal influences.

A Case from Practice.

A Complete Presentation of the Details of Its Treatment.

By Calvin S. Case, M.D., D.D.S., Chicago, Ill.

In response to the very kind invitation of your Program Committee to present a paper and a clinic before this society, and wishing to avoid as far as possible subjects of a former controversial nature, of which time and the co-operating forces of experience are the true moulders toward truth and progress, I have concluded that I cannot bring to you anything that will be of greater interest, especially to the younger members of this society, than the well authenticated history from the very start to the finish of some typical case that is not uncommon in practice, and which requires a number of distinctive characters of movements and appliances for its correction and retention. This will give me an opportunity to call your attention to some of the most modern principles and techniques employed in my practice and teaching for the correction of malocclusion. And then as an interesting and perhaps instructive supplement to the paper and its lantern illustrations, the case will be continued at my clinic, which will give an opportunity to those who desire to more closely examine the stock material and the finished appliances set up on the models, showing different stages of the case, and every detail in regard to material, sizes, technique, construction, assembling, adjustments and application of the various forces of correction, and retention.

The case which I have chosen to present for this paper is one of peculiar interest and applicability, because in the first place it teaches the importance of a careful and thorough study of every case, however apparently simple and uncomplicated it may at first appear; and why an artistic observation of the facial outlines should be regarded as one of the foundation principles of intelligent diagnosis.

Second. It shows how from the local cause of adenoids, followed with long continued early mouth breathing and inhibited maxillary development, may arise three distinctive characters of malocclusion, i. e., decided malalignments of the permanent teeth, open-bite or infra-occlusion of the front teeth, and finally a bodily retruded position of the upper incisors and entire intermaxillary process.

Third. It will conclusively demonstrate the remarkable effectiveness of the resilient forces of exceedingly light arch bows and delicately constructed bands and unique attachments, which have been aptly termed the "midget appliances," and which are particularly adapted for the correction of the common malalignments of children's teeth.

Fourth. It will show the most modern technique and application of the regular bodily movement apparatus whose principles of force have been successfully employed for twenty-five years for the correction of the most extensive retrusions and protrusions. This was named the "contouring apparatus," because of its early surprising capability of developing and correcting depressed facial contours through a bodily labial movement of the front teeth. It was afterwards discovered that this same principle of applying force to the teeth, according to the law of levers of the third kind, was quite as applicable for bodily lingual movements of the front teeth; and in recent years this same mechanical principle has been extensively employed for bodily movements of the teeth in every direction. In fact, no teeth were ever moved bodily except through the application of this principle of force, which consists in the establishment of independent points of fulcrum and power in relation to the alveolus or area of work. Even that valuable addition to our technique principles of torsional force for the bodily movements of teeth, presented recently by Dr. Angle, and exemplified in his new appliances, is reducible in its direct action to that of a lever of the third kind.

Fifth. This case will also present an opportunity to examine at the clinic the most modern methods in the technique construction and action of the regular bodily *working* retainer, it having been necessary to remove the regular bodily movement apparatus before its work was completed, as will be more fully explained.

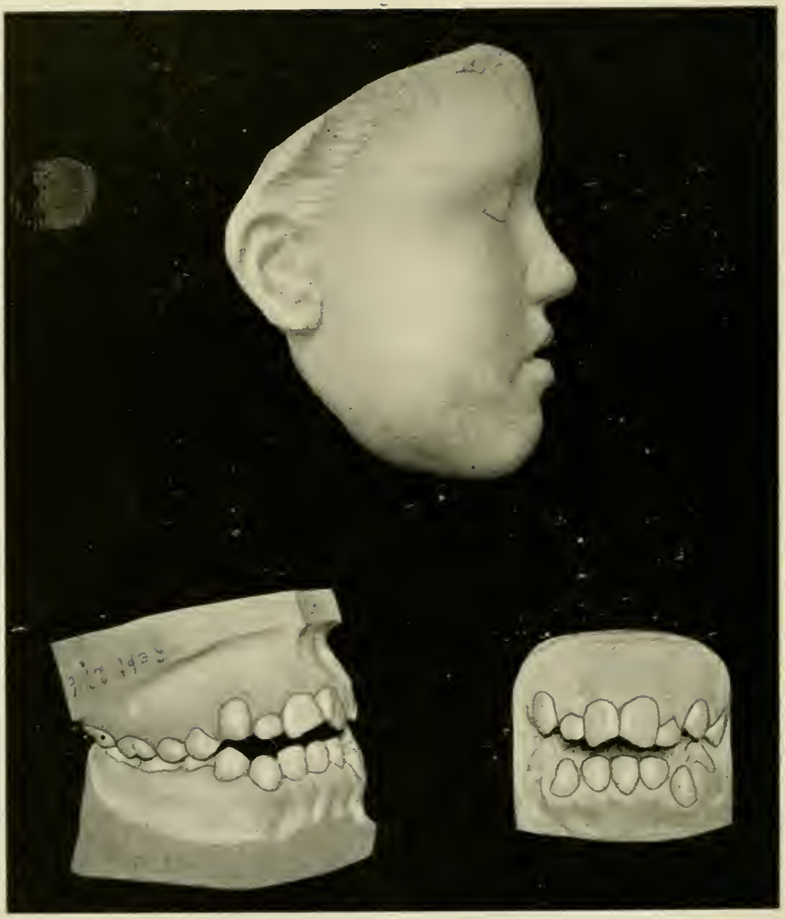

Fig. 1.

Sixth. You will also have an opportunity to examine the regular six-band retaining appliance similar to those that have been employed in nearly every case in my practice for over twenty years.

As Dr. Carl Case has kindly consented to assist me at my clinic, if facilities and time are offered, we hope to show the technique construction of this appliance. The case referred to is that of a Miss about thirteen years of age. The first impressions—the plaster casts of which are shown in Fig. 1— were taken September 27, 1916. Both right and left sides were so alike in buccal occlusion it is unnecessary to show but one side, as you will see when we come to other views. It will be noticed in examining the buccal occlusion that the upper denture is slightly distal to normal, and that the upper incisor teeth, though appearing to be prominent at their occlusal edges, have their roots decidedly retruded, being labially inclined from deepened incisive fossæ. The apparent prominence of the upper incisor crowns is enhanced because of the retruded position of the lower incisors, which is due to the unfortunate extraction of a lower lateral incisor, which I am told occurred soon after its eruption in lingual malalignment. From the facial cast it can be seen that the chin and lower lip are quite perfectly posed, and in harmonious relation to the main, or unchangeable features of the physiognomy, showing that the mandible and lower denture are in normal relations. The moderately retruded outlines of the upper part of the upper lip with the abnormal deepened naso-labial lines, enhancing the prominence of the cheek bones, gave to the physiognomy—especially from a front view—an unnatural and decidedly unesthetic broad and flattened appearance. The facial diagnosis, in connection with the retruded relations of the upper incisors and marked open-bite malocclusion, definitely indicates that its cause was early adenoids and mouth breathing; the former inhibiting the normal development of the maxilla, and the latter—which doubtless continued through several years of early development—resulted in the open-bite malocclusion.

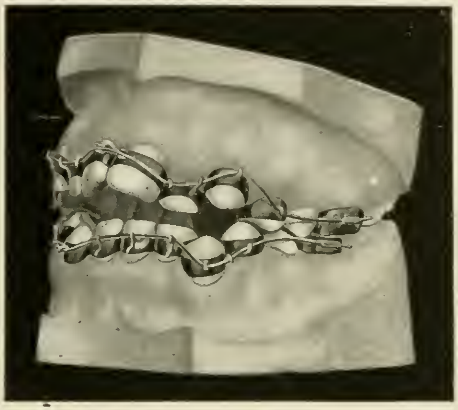
Fig. 2.

From the above diagnosis it will at once be observed that the case belongs in Class III of the dento-occlusal classification, and that the main and imperative part of the operation demands a bodily labial movement of the upper incisors and incisive alveolar process, accompanied by a general maxillary enlargement through bone growth development, to correct dental and facial relations.

In all cases in which a bodily movement of the front teeth is demanded, it is first quite imperative in my practice that they be placed in alignment so that they can be brought evenly within the firm grasp of the power arch bow, and thus moved bodily in phalanx. For the purpose of accomplishing this first stage of the operation, and incidentally to correct the alignment of the lower teeth and open-bite malocclusion, I first employed the apparatus shown in Fig. 2, which is similar in general character to that which has been commonly employed in my practice for years, for the correction of all simple irregularities in alignment and malposition of the teeth of children and youths. It is that which derives its main motive force from the resiliency of very light arch bows which range in diameter sizes from Nos. 22 to 26 (.025" to.016"). To those who are not familiar with the gauge sizes, it may be well to state that No. 22 is about the size of a small pin, and No. 26 is but a trifle larger in diameter than the thickness of a 28 gauge plate of which all of you are familiar.

German Silver Arch Bows.

There is no objection to employing any of the alloys of gold and platinum for the arch bows, if specially drawn, but for all intents and purposes 18 per cent. nickel spring German silver wire if properly drawn, will answer every requirement. Orthodontists who have not tested the possibilities of high grade German silver can hardly realize the higher degree of spring temper and resiliency that can be given to arch bows of this material when drawn *cold* from very much larger sizes.

The arch bows of the above small sizes, if intended for the purposes referred to, should be drawn from Nos. 14 to 16 high grade spring German silver wire, without annealing, and kept cold in the process with a small bag of pounded ice over the drawn plate.

The particular characters of malocclusion for which these very light resilient arch bows are especially adapted, are those which are commonly composed of a variety of malpositions that arise during the early eruptive stages of the permanent teeth, and which are commonly due to local causes. I need not here enter into extensive detail in regard to these midget appliances or the techniques of the delicate bands and attachments, as this was fully published in the April, 1917, number, of the Dental Items of Interest. Nor can they be appreciated unless one sees the appliances and notes with what ease and facility the treatment adjustments can be accomplished. In the apparatus here shown the arch bows are No. 26. The bracket attachments on the lower incisors—which will be better shown by an examination of the appliances—are for direct

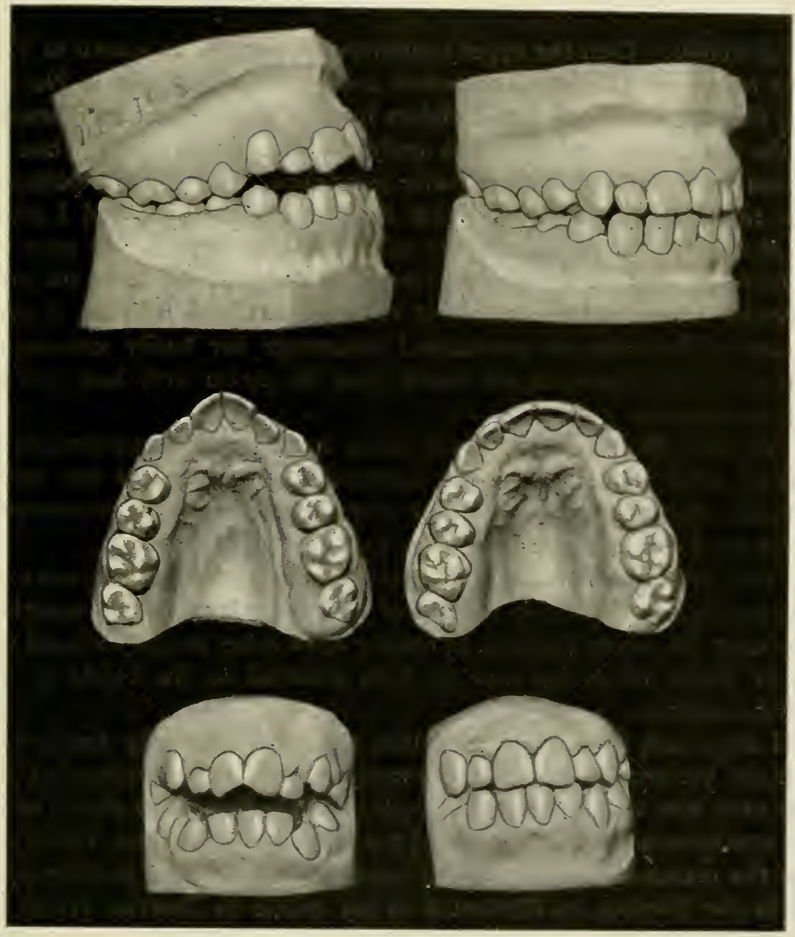

Fig. 3.

intermaxillary elastics to aid in closing the open-bite. After this apparatus was placed on the teeth, and the patient instructed in the adjustment of the elastics, I did not see the case oftener than once in two weeks. Occasionally at these times, the arch bows were removed and replaced with fresh ones, and minor treatments performed as the changing conditions demanded.

Rapid Results of Treatment.

In less than four months after these appliances were attached, the upper front teeth being sufficiently in alignment for the bodily movement apparatus, they were removed and impressions were taken for the models shown on the right of Fig. 3. On the left is a view of the beginning models. Then the upper contouring apparatus, as shown in Fig. 4, was made and placed. The power arch bow in this case is No. 16 spring German silver rolled to a ribbon form of about ⅔ of its diameter over the labial area, and placed to apply its force at the gingival line of the front teeth, and not upon rootwise extensions. For younger patients, I now rarely apply the power above the gingival margins, and I often place the fulcrum bow near to the middle of the crowns. It must be seen however, that the further the line of power is placed from the area of alveolar work, and the nearer it is to the artificial fulcrum, it proportionately decreases its mechanical advantage for bodily movement, and consequently increases the strain upon the power arch bow and its molar anchorages.

The only object in applying the power upon rootwise attachments to the front teeth is to increase the mechanical advantages of the whole apparatus, which is quite important when extensive bodily movements of front teeth are demanded for older patients.

Those who find it difficult to construct the upright attachments on the upper incisors in which the power bow rests back of the uprights, may prefer, for young patients, to employ open tubes to clasp around the bow, or hooks which lap over it, both soldered to the bands at the gingival margins.

If they wish to combine with this, the torsional bodily force, they can easily construct the hooks to exactly fit a ribboned portion of the power arch bow which is rolled at such an angle that when placed in its front attachments the distal ends of the bow, at equilibrium, will stand below the occlusal plane, making it necessary to lift them to their positions in the U-tubes, as illustrated in my article in DENTAL ITEMS OF INTEREST.

I would advise however, from some experience I have had with this method, that the fulcrum bow be not omitted, and the power bow be not less than No. 19. I hope this will not be regarded as an adverse criticism of Dr. Angle's new appliances of which I have no right to judge from an experienced standpoint.

The amount of correction at this time, of the infra-occlusal position of the front teeth shown by the front occlusal models in Fig. 3, was accomplished mainly by direct intermaxillary elastics attached to the midget hook and bracket attachments upon the front teeth.

At the anniversary clinic of the Chicago Dental Society, January 27, 1917, four months after, the patient attended by her older sister, kindly consented to appear and patiently submitted to hours of examination and questioning by hundreds of dentists. She was wearing at that time the upper contouring apparatus shown in Fig. 4, a duplicate of which you will have an opportunity to examine. The plaster dental and facial casts and the mounted apparatus which had accomplished its work up to that time, were shown and explained. I am particular to mention this circumstance—parenthetically—because it establishes the unquestionability of the above dates. I wish to say also: the appliances and models of this case were employed to partly illustrate a paper which I read before the Southern Dental Clinic at Atlanta in March, 1917, and no doubt will be published with the proceedings of that meeting.

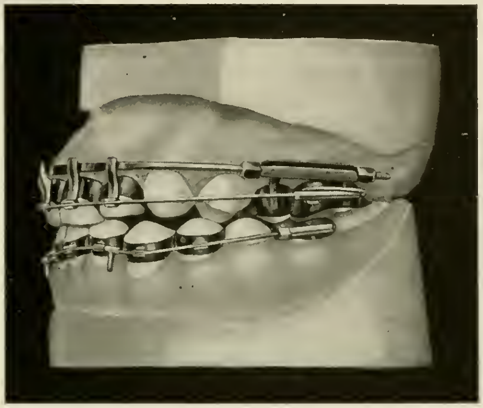

Fig. 4.

Rapid Work Not Essential.

You will pardon me for saying that I hesitated in presenting the true chronological history of this case for fear that someone might imagine that I regard rapidity of orthodontic movements as the test of the value of methods, whereas, it will be found throughout my entire teaching that that particular phase of an operation is negligible compared to the selection and application of methods which are best suited to the needs of the case in hand; and which will accomplish the most favorable results. In fact, I doubt if the best accomplishments can be attained in the correction of many cases of malocclusion in an attempt to hurry the operation. While time, ease of adjustments, painlessness, non-irritability and artistic effects are of great importance, they should never stand in the way of truer principles of practice, even though lacking in some of these most desirable qualities.

Occasionally, as in this instance, we will meet with cases which safely respond with phenomenal rapidity, if the forces are skillfully adjusted to their needs.

The second lower apparatus, the front of which is shown in Fig. 4, was placed a few weeks after the patient had become accustomed to the upper. The lower front teeth were now nearly in alignment and consequently in a position to be more firmly grasped by a No. 23 expansion arch bow which would sustain, with greater stability, the distances between the molars and front teeth and exert a slight general expanding force, and at the same time permit the proper action of the disto-mesial elastics for the reinforcement of the upper anchorages, and the adjustment of the occlusion. Provision will be seen on the lower for the direct intermaxillary elastics to continue the extruding force—particularly the upper cuspids and bicuspids.

I do not wish it to be inferred that the forces of any of these appliances alone were the only treatments employed, because in this, as in nearly every case, the skillful orthodontist will employ subsidiary forces as the case progresses, which are quite as important as the main forces for keeping the machinery in perfect co-ordinating action. With me these side forces are mainly obtained with light silk ligatures and elastics. Moreover, it is the rule in my office that when bands or their attachments have outgrown their usefulness, or are not properly constructed or adjusted to perform their best work, they are immediately removed and corrected—more often with new bands and attachments for varying the force.

Use of U-Tubes on Anchor Teeth.

There is one thing to which I wish particularly to call attention as one of the recent and most important improvements in the techniques of anchorages. It is the employment of the U-tubes instead of closed or seamless round tubes for the ends of the arch bows. For the very light resilient bows a seamless tube on one side and a U-tube on the other is usually sufficient. But for the larger bows, with locked attachments to the front teeth, which are designed to exert a lateral expanding force, and especially those which are intended to exert a bodily torsional expanding force, U- anchorage tubes are invaluable, because they enable giving to the bow any desired spring force, and with assured ease of assembling. And then when desired, the ends can be readily lifted from the U-tubes and given an extra spring force and replaced without the necessity of unlocking the bow from its front attachments. This is especially important for the more rigid power arch bows of the contouring apparatus. It occasionally becomes necessary to remove these bows to increase or decrease their expanding properties, or to correct some irritating action that arises at the front. Formerly this was impossible without a complete removal of all the front bands or the stationary anchorages,

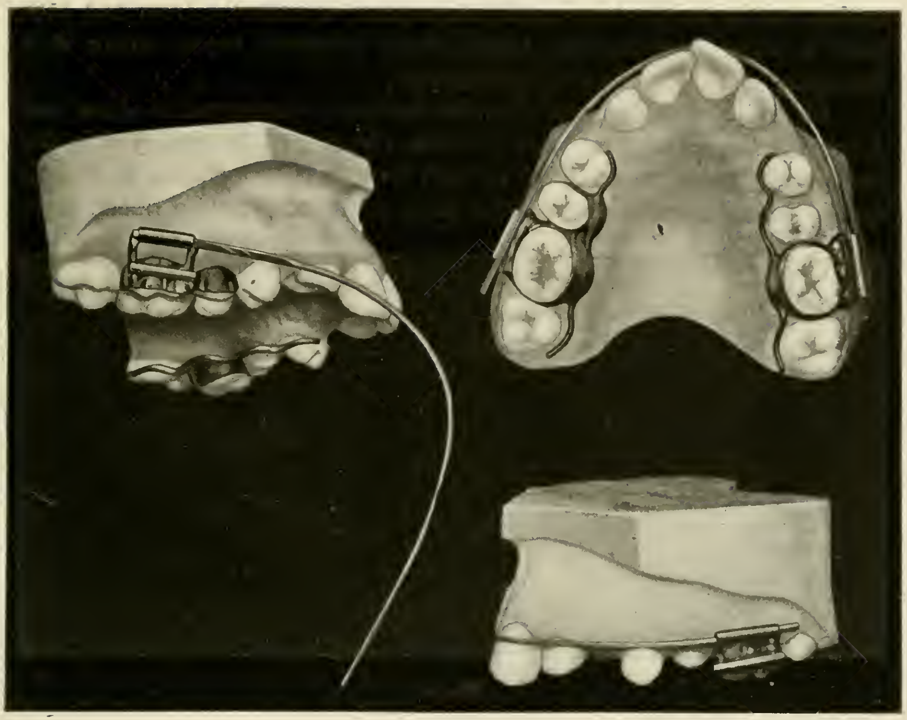

Fig. 5.

which is not always a very easy operation, without slitting them. Now the counter-sunk nuts which lock the ends of the bow in the U-tubes are unscrewed and the bow is easily lifted out of its attachment at the back and then at the front, and as easily replaced, without disturbing any of the bands.

Anchorage above Gingival Line.

There is another important improvement of somewhat recent date in the techniques of anchorages where great stability is demanded. In addition to the invaluable advantage of the two or three band stationary anchorages—this more recent improvement consists in applying the anchorage power above the gingival margins upon rootwise anchorage attachments, shown in Fig. 4. This places the direction of the power more nearly in a line with the center of alveolar resistance. and proportionately increases the stability by decreasing the tendency to inclination movement. The rootwise method of applying force is invaluable in all bodily movements. Besides the labio-lingual bodily movement of the front teeth, it is of great advantage in the bodily expansion of dental arches, and in bodily disto-mesial movements of both the front and back teeth to close interproximal spaces, from whatever cause, where it is important to avoid inclination movement.

Fig. 5 illustrates an appliance that has been constructed to show how a combination of torsional and rootwise forces may be employed in the bodily expansion of arches. The arch bow in this appliance is No. 19 special spring German silver, rolled distal to the cuspids to a ribbon form of about 2.3 its diameter in thickness, and at an angle—in equilibrium—that will twist the ends of the bow one-quarter to one-third the way around when sprung into the U- anchorage tubes, and in a direction so that the force of the upper, or rootwise edge of the ribbon will be exerted in a buccal direction. The lingually directed force of the lower edge is supposed to be more than neutralized by the direct expanding force of the bow.

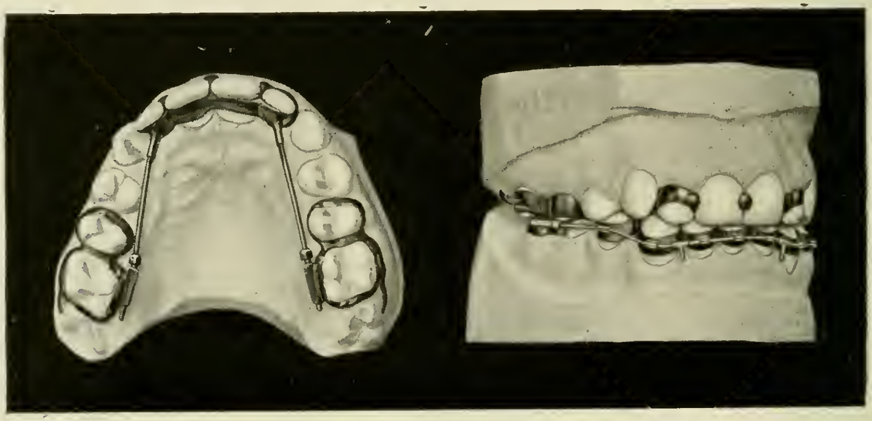

Fig. 6.

This method has never been tried in my practice, but I have no doubt that it is of considerable value, provided the arch bow is sufficiently large to exert the requisite force. Up to the present time, I have been fairly successful in the bodily lateral expansion of arches by applying the force upon rootwise extensions.

Working Retainer.

To return to the case under consideration: After the bodily movement apparatus had been worn about four months, I was informed that it would be necessary for the patient to return to her home in Oklahoma on account of the sickness of her father, and that I probably would not be able to see her but a few times until near the close of the operation. As the bodily movement of the upper teeth and the general correction of the malocclusion had progressed quite favorably, and fearing to trust to others in this advanced stage the treatment adjustments, I decided to place the bodily working retainer on the upper incisors which would continue, more slowly but safely, their bodily movement.

Fig 6 shows two views of the working retainer on the model of the upper teeth at this time. The lingual push bars are No. 19 spring German silver, fitted but not soldered into the thick wall clasp metal tubes which are attached to the clasp metal reinforcement-backing of the retainer. The distal ends of the bars at equilibrium are about 3.8 of an inch below the occlusal plane, and when sprung into the U-tube attachments on the lingual surfaces of the stationary anchorages, exert a labial force upon the roots of the incisors; which in connection with the action of the nuts at the mesial ends of the anchorage tubes, result in a bodily labial movement.

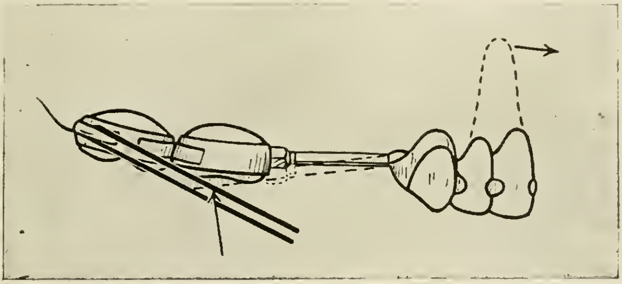

Fig. 7.

The object of the two-band stationary anchorages is to distribute the extrusive spring force of the bars and prevent a supra-occlusal movement, as would naturally occur if this force were sustained by single molar anchorages. The disto-mesial and direct intermaxillary and other forces were continued with this apparatus.

As stated in my textbook published in 1908, and illustrated with the drawing shown in Fig. 7, and also in a paper read before the Orthodontic Society in Paris in 1914; there is no reason why this bodily movement working retainer should not be employed for many of the bodily labial movements of children's teeth, and in fact in all cases for young patients when required movement is not extensive. It certainly has the very great advantage of inconspicuousness, and non-irritability to the lips. It admits also of perfect cleanliness and like the six-band retainer, is, in my opinion, far and away the most artistic orthodontic appliance I have ever constructed.

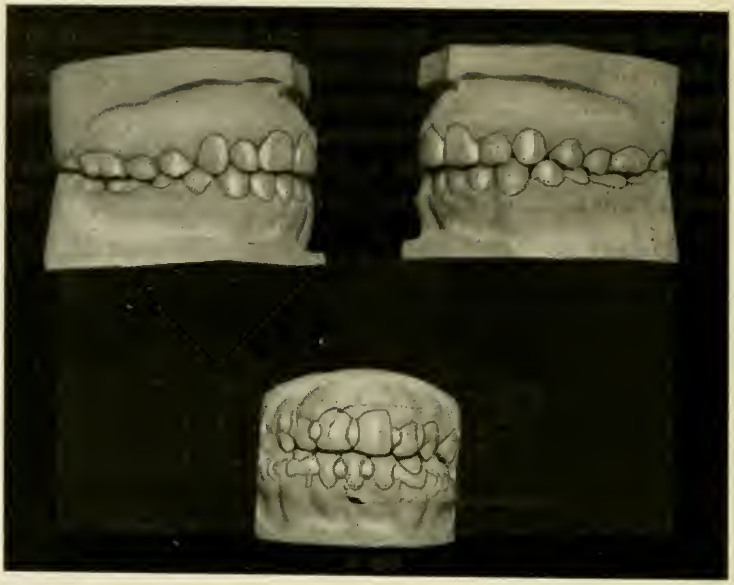

Fig. 8.

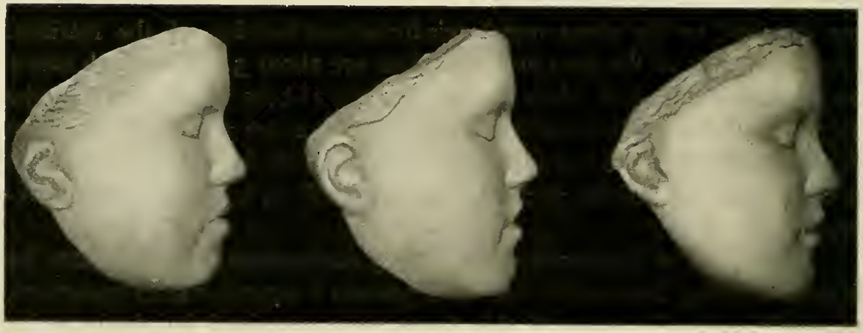

Fig. 9.

During the absence of the patient, she very faithfully kept up the application of the various forces. She returned to me about two weeks ago. On Wednesday, August 29, 1917, eleven months after starting the case, all the appliances were removed, and the impressions were taken for the plaster casts shown in Fig. 8. Notwithstanding the unfortunate fact that there are only three lower incisors, the dentures are in fair occlusion which time will improve. Below is a front occlusal view of the teeth in which is faintly shown the final retainers in position. You may be able to see the supplemental spurs for the attachment of the direct intermaxillary retaining elastics for contouring the extrusive force to prevent a return of the infra-occlusal position. Also the hooks on the lower for continuing the disto-mesial intermaxillary force.

Fig. 9 will give a fair idea of the development in the facial outlines by immediate comparison with the beginning facial cast on the left. The plaster impression for the one in the middle was taken upon the removal of the regular bodily movement apparatus which was worn about four months. The impression for the one on the right was taken about one week ago. When you come to examine the plaster dental models of the upper, made at this time, you will see that the roots of the incisors are abnormally prominent in relation to the alveolar process—especially above the ends of the roots. Therefore, if the upper incisors are retained in their present bodily labial position, the facial outlines will no doubt continue to improve through stimulated growth development.

Discussion on Dr. Case's Paper.

Dr. C. A. Hawley, Washington, D. C.

I am very sorry to be asked to open the discussion on Dr. Case's paper without having had time to read it carefully and give the matter more mature consideration, and I hope that what I may say will be considered from that standpoint.

Anything that Dr. Case presents to a body of orthodontists is entitled to most careful and favorable consideration. We all know the work he has done for orthodontia and the long years he has devoted to the art. The results he has obtained in this case, it seems to me, are almost above criticism. One feature which he has not emphasized has interested me very much, namely, beautiful occlusion of the teeth, and still the patient is shy one more incisor. I am very much impressed with the results that have been obtained with these very delicate appliances which Dr. Case has shown.

Dr. L. S. Lourie, Chicago.

I would like Dr. Case to explain the action of this fine expanding wire which he uses. I did not read his previous article. I was away from the city at the time when the article was published and I did not see it, but I have heard those who have seen the appliance say that the little spring arch is not fixed rigidly to the individual teeth. Am I right, Dr. Case?

Dr. Case.

Yes.

Dr. Lourie.

That is an important point which should be emphasized by Dr. Case, and it will bear repetition because it is important. I believe it is a great improvement over the Angle ribbon appliance or the Robinson appliance in which the arch is definitely fixed to each tooth. You have the regulating force of the spring. The spring as it acts has a changing reaction on all teeth, whereas, with Dr. Case's method, the arch is not rigidly attached to the various teeth by means of the band.

Dr. R. Ottolengui, New York City. If I am correct in my understanding of the appliance, I would emphasize the fact that by only using the arch once and starting every time with a new one, you are not complicating your work with repeated bends as you do when you use one arch all the time and endeavor to make new bends do new work.

Dr. Calvin S. Case. There is much in the illustrations of the paper, which will be far better shown at my clinic. I have with me all the appliances which show the special attachments and how they are placed and soldered. You will have an opportunity to see how readily and effectively the forces are applied and changed; and with what ease and rapidity these small resilient bows are wound in and out along the line of attachments from the U-tubes on the molar anchorages, and then after they have been worn a week or two, how readily they can be removed and replaced with new bows.

Dr. Fischer. Why do you put on a new one?

Dr. Case. Of course you can easily straighten the original one, but they are so easily made and so inexpensive, if of German silver, one would hardly take the trouble. The action of this force, as in all resilient elastic forces, no doubt has a great tendency toward stimulating the activities of bone growth development; especially is this noticeable in those cases of narrow arches during the early stages of secondary dentition where there seems to be insufficient room for the eruption of the incisors between the deciduous cuspids. In many of these cases where it would seem as if the spring of the bow would tend to drive the cuspid area into the arch and thus prevent labial area enlargement, it absolutely acts in the opposite direction. By forcing the lingually malposed teeth into line, they are made to act as expanding wedges, and with the renewed stimulation of growth, the arches are seen to assume the required proportion for the normal eruption of the permanent teeth.

Constitutional Diseases in Infancy and Dentition.

By Dr. G. Lippman, St. Louis, Missouri.

I deem it a great privilege to appear before you to-day as a representative of a specialty, that is like yours, deeply concerned with the welfare of the young. It is only a short time since we have learned to realize the necessity of the different interests in medicine meeting together, a neglect not only detrimental to the followers of the profession, but also to suffering mankind. Those combined meetings must of necessity develop the curative side, as well as the preventative of our science.

You all know what has been done in a prophylactic way in the prevention of infant mortality, a result, that was only made possible by putting the feeding of the very young infant on a scientific basis. But to keep infants alive could not for a long time be the only aim of the new science of pediatrics; its aim had to become the rearing of healthy human beings.

The close interrelation between the process of dentition and the health of the child, between mastication and growth, has not received sufficient consideration. We have only a short time ago rescued this absolutely normal physiological process of cutting teeth from a mire of superstition. What innumerable symptoms were not ascribed to this act! We know to-day that this has little or no effect on the well-being of the infant, but now since we are fully convinced of the harmlessness of the process of the appearance of the teeth as such, we have learned more and more to recognize the importance that is attached to the preservation of healthy instruments of mastication and of their normal juxta- and contraposition.

To know how to prevent the now so prevalent dental caries and malocclusion demands of us to look carefully into the scientific cause of these pathological conditions. The fact cannot be too strongly emphasized that there is no evidence that will bear scientific investigation, that the teeth of this age as such, are congenitally not as strong, or better said, as normal, as those of our forefathers. The prevalence of dental disorders must therefore be looked for not in a change of the character of the teeth themselves but in the malign influences to which they are subjected. Fortunately the indestructibility of these tissues enables us to compare them with those of our ancestors.

Caries and Pyorrhea Modern Disorders.

We find that only a few generations ago, dental caries was almost non-existent or at least rare, while during the last fifty years caries and pyorrhea have become so prevalent, that a good set of teeth is looked upon as marvelous. We know that among the Maoris of New Zealand as long as they existed on native diet, caries was found only in one per cent. of all the aborigines, but after seventy years of more or less civilization this condition occurs in about ninety-five per cent. of Maori children. Living under European influence produced a change which coincides with that rampant under the full influence of modern Western environment.

Infant Feeding.

This ought to and really does give us a perfect clue to the right direction which we must follow in the raising of normal children. The child has the indisputable right to demand to be fed from the mother. Cows' milk is there to raise calves, human milk to raise human beings. But this is not the only point to be considered, we must appreciate the fact that the act of taking nourishment from the breast differs from that of sucking from a rubber nipple. The emptying of the mammary gland calls for an increased muscular activity on the part of the infant, so that the alveolar arches become more fully developed. The highly roofed palate and narrow arch is of rare occurence in children that are breast-fed for the first eight or ten months of life. But the quality of the teeth also depends on the supply of natural food. The teeth of breasted children are much better calcified than the teeth of children raised on cows' milk. So marked is the difference in the structure of the teeth that we are in a position, with almost a certainty, to pick the child that has been breast-fed.

At the age of eight to ten months, the time of weaning has arrived and contemporaneously the incisors appear. These implements of gnaw-ing surely have a purpose. Is milk still to be the only means of sustenance to be given to this child? Most assuredly not. But what is the usual diet ordered now? We prescribe a mixture of milk with mush or toast, sweetened, soup, mashed potatoes, and vegetables run through a collender. Is that the diet aborigines gave to their children? The infant at the appearance of the teeth likes to bite on something hard; by instinct, he tries to get nourishment from a hard substance. Milk, of course, must be given to the child, but the carbohydrates should be supplied in the form of hard toast, or stale bread. Later on, when the molars have made their appearance, a food should be given that necessitates grinding and milling.

If only a finely divided food is offered, the child will bolt its food and will grumble if it has to chew. It is hardly necessary to mention here in condemnatory terms the deleterious custom of giving soft sweetmeats at the end of the meal. The meal should be concluded by the chewing of a piece of hard toast and, if possible, followed by fresh fruit, especially a slice of an orange. This enforced mastication will not only do more in the prevention of caries than the most careful use of the tooth-brush, but will show its good effects in another direction. The biting on hard substances must of necessity promote the development of the jaws and must produce larger arches for the teeth to erupt into. With a better arch the high-roofed palate cannot occur so frequently. While this would undoubtedly permit a freer passage of air through the anterior nares, a full working of the muscles of mastication, owing to their attachment, would also tend strongly to widen the posterior openings of these parts by the pull on them. The distinct tendency to an inadequacy of the nasal passages might be overcome practically by a rational method of infant feeding.

We have remarked before that almost any infant raised on cows' milk shows the consequences of it in its susceptibility to dental caries. We pediatricians recognize three classes of infants in relation to cows' milk feeding. A comparatively small number of infants cannot be raised on cows' milk at all, the second type can be raised on cows' milk and the third may be raised on this food only with great difficulty, and let me assure you that the last class is a very numerous one, or the graveyards would not be filled with the corpses of the very young.

The frequent disturbances in the growth of the child caused by the unnatural character of the food accounts for the retardation of bone and tooth formation and a decrease in their resistance.

Congenital Predispositions to Disease.

Furthermore, we have to make mention of two congenital predispositions to disorder or disease. First, the racchitic diathesis, and second, the exudative diathesis. Both play a very important rôle in producing dental disturbances, caries as well as malocclusion.

I do not intend to go deeply into the pathology of rickets, but will simply mention the fact that in rickets the young bone tissue does not calcify sufficiently or even does not calcify at all. Bones that were fully developed lose their lime salts during the course of the disease. Dentition is of necessity strongly influenced. The first teeth do not begin to appear at the regular, expected time, a decay occurs that sometimes puts the appearances of the first tooth off to the beginning of the third year. The interval between the cutting of the teeth is prolonged. Dentition may come through in the most irregular way.

The incisors of the upper jaw are usually very small, soft and friable. They show a greenish discoloration and are almost always susceptible to caries, a caries that sometimes completely amputates the teeth. The formation of tartar is excessive. The temporary teeth are frequently eroded around the neck and roots, while the permanent teeth, already damaged before their appearance, show also erosions on the body and the cutting edge. Of special interest to the orthodontist are the malformations caused in the jaws by this disease. The lower jaw is shortened in the sagittal direction, effecting what is technically called the trapezoid form of the lower jaw. The upper jaw is lengthened in the frontal direction producing a lyre form. The lower alveolar processes show a tendency to turn in, the upper alveolar processes a tendency to turn out, thus creating the picture of malocclusion so well known to you all.

This is the picture of the damage done by this disease so far as it is of especial interest to the followers of dental science, of the harm caused to osseous system in general and of its destructive influence on the child as a whole. I do not want to discourse here, suffice it to say, that it is absolutely necessary to be able to diagnose rickets in its very beginning, before permanent malformations occur. The symptomatology of early rickets is as follows:

A child that has always been lively shows less vigor and cries easily. It buries its head into the mattress or pillow and moves it from side to side until the occiput becomes bald. During sleep it perspires freely around the head. So much so that the pillow shows the mark of the perspiration. Characteristic of this sweat is its stickiness and its peculiar sour odor. While these early symptoms prevail, no change in the osseous system has taken place, they only occur weeks afterwards. The time for interference is clearly indicated, and while we are not in possession of the absolute knowledge of the pathogenesis of the disease, while one theory chases the other as to the cause of rickets, we are well able to deal with it in a curative manner—fresh air, massage, exercises and baths are indicated to improve the general condition. This combined with the internal use of phosphor cod-liver oil is an absolutely sure way to overcome this malady and prevent all its malign consequences.

The Exudative Diathesis.

Let us now see in how far the other diathesis, the exudative diathesis should be of interest to you. The exudative diathesis derives its name from the tendency of the patient to exude easily from the skin and the mucous membrane. The primary disturbances of the skin consist in the appearance of brownish black, adherent spots on the hairy part of the scalp. The skin of the cheeks is reddened and thickened, giving it an eczematous quality. Behind the ears we may find an intertrigo, an oozing skinfold, very resistent to treatment. The tongue shows the characteristic picture of the so-called geographical tongue, produced by exudations on its surface with an increased prominence of the papillæ, the white spots being caused by a peeling off of the epithelium. Of greater importance than those changes, occurring on the outer skin, are those connected with the upper air passages. The tonsils and adenoids are early and consistently enlarged. It would be "carrying coals to Newcastle," were I, a physician, to speak to you of the influence of mouth-breathing on the correct occlusion of the teeth. Here, the same as in rickets, we are in darkness as to its pathogenesis, but we do know how to prevent this symptom-complex from doing permanent injury to the young infant. It rests solely on the diet prescribed. The régime must be so arranged, that an accumulation of adipose tissue on the part of the child is prevented. The weight of the patient must be kept in certain limits, without weakening him.

Syphilis.

We cannot conclude these short remarks without mentioning one more specific pathological entity, that exerts at times a pronounced influence on the teeth, and that is syphilis. With a disease so fully known to science as lues, and with the profession in the possession of a cure, if there is a cure in medicine, there is hardly any excuse for its harmful aftereffects. In speaking of the teeth in connection with this disease, we have to mention here the name of the famous English clinician, Hutchinson, who first carefully studied and described the changes produced by syphilis on the teeth. But let me advise you to follow his careful description closely. The upper middle incisors show on their cutting edge a half-moon-like concave tissue loss, and frequently, though not always, the dentin becomes visible. The teeth are barrel-shaped. I mention this classical description here because only too frequently the diagnosis of lues is made by mistaking the inroads made by rickets for those made by syphilis.

Conclusions. 1. Dental caries, being a disease of civilization, does not rest on congenital lack of resistance. The cause must be looked for in injudicious feeding.

2. The racchitic and exudative diatheses must be counted among the causative agents of dental malocclusion and caries.

3. The influence of syphilis on the teeth is of comparatively minor importance.

The Therapeutic Efficiency of Oral Preparations.

By HERMAN PRINZ, A.M., M.D., D.D.S., Philadelphia, Pa.

Oral Hygiene.

The science of oral health treats of the preservation of the normal equilibrium of the oral cavity and its contents. The remedies intended for the maintenance of the health of the soft structures of the mouth and the teeth may be conveniently divided into those prescribed for specific diseased conditions and those employed as hygienic measures for daily use. In the mouths of most civilized races, the mucous membrane, on account of the present perverted methods of preparing and seasoning our foodstuffs, is found more or less always in a state of mild chronic inflammation, while the hard structures of the oral cavity, the teeth, are subjected to a process of molecular destruction known as dental caries.

Dental caries is not a disease in the same strict sense of the word in which the latter term is usually applied, but is "a process distinctly allied, both in its chemic and bacteriologic aspects, to the general phenomena of putrefaction" (Goadby). While certain preliminary intrinsic causes, i. e., anomalies of position, outline and structure, etc., may profoundly alter the predisposition of the tooth to carious destruction as a whole or in part, dental caries will always occur if a tooth is subjected to the influences of suitable environments, and it does not matter whether the tooth forms an integral part of the anatomy of the individual, or whether it is separated wholly or in part from its original owner. The late Miller has formulated an explanation of the nature of the carious process, which at present, is universally accepted, and which defines this phenomenon as a chemico-parasitic process consisting of two definite states, i. e., the decalcification of the tissues and the dissolution of the remaining organic matrix. In caries of the enamel, the latter phenomenon is not observed on account of the minute quantities of organic matter contained therein. The accumulation of carbohydrate food débris on and about the teeth is held directly responsible as being the incipient factor in the production of the decalcifying agents. The direct or indirect splitting up of these carbohydrates by fission fungi into acids, i. e., principally lactic acid, furnishes the attacking agent which decalcifies the enamel. The further changes occurring in this process of tooth disorganization do not interest us at this moment.

The hygienic care of the mouth intends primarily to keep the mucous membrane and the teeth in a state of healthy equilibrium by overcoming the above enumerated morbific processes. Nature has instituted protective measures of her own to accomplish the desired end. The normal mouth is fairly well protected against the continual onslaughts of the omnipresent bacteria through an unusually rich blood supply of the oral tissues, a high resistance of their epithelial lining, and a free flow of saliva. The vigorous use of the organs of mastication during the chewing of properly selected food will bring about an active circulation and stimulation of the parts involved, and, as a sequence, a rich flow of saliva required for the washing away of food débris and for the preliminary digestion of carbohydrate food is always insured.

Human Saliva.

Human saliva represents the mixed secretions from the three pairs of salivary glands and the minute mucus glands distributed over the oral cavity. Saliva may be defined as a weak solution of alkalies, as present in the body juices, more or less saturated with carbon dioxid. It contains, furthermore, several organic substances, among which mucin and the several ferments which accelerate the changes of starches into maltose, i. e., the hydrolysis of polysaccharids into soluble disaccharids. The ferments of human saliva are principally represented by the carbohydrate-splitting type, i. e., amylase (ptyalin) and maltase although oxydase and catalase are always present in more or less variable quantities. The physiologic function of mucin consists in mechanically assisting the food bolus in its easy passage into the stomach and to protect the oral tissues against irritating substances.

The biologic laws governing the secretions of saliva are directly responsible for its composition, its quantity, and its influence on the digestion and, incidentally, on dental caries. Only the most fundamental facts concerning these biologic aspects can be touched upon at this moment. The secretion of saliva depends upon nervous impulses. The quantity of saliva secreted, that is, the rapidity of its flow, depends upon the physical nature of the irritant (foodstuffs). Psychic stimulation is of less importance in this connection. Incidentally, the composition of saliva depends very largely upon the rapidity of flow, i. e., its organic and inorganic contents are primarily the sequences as produced by the nature of the irritant. The irritant induces these changes, not merely in the oral mucous membranes, but also in those of the stomach. The latter seems to respond through the formation of hormones. Apparently, as has been shown experimentally by Pawlow and his pupils, saliva is a glandular secretion capable of adaptation. However, the fundamental basis of the secretion of saliva rests with the process of mastication. The degree and the manner of mastication accelerates or diminishes very materially the nature of the irritant. The much discussed alkalinity of saliva depends directly on its ash contents; the more ash the higher the alkalinity. With an increase of the rapidity of flow an increase of alkalinity is always observed. Alkalinity of saliva as determined by titration is always a "one man's" finding and not to be relied upon. To determine correctly the reaction of a fluid which as saliva, hovers so closely near the neutral point, the electrometric measurement of the H-ion concentration is the only permissible scientific method. The writer has successfully employed for such work the gas-chain apparatus as modified by Michaelis. The reaction of normal saliva, i. e., saliva collected during periods of physiologic rest of the salivary glands is so very weakly alkaline that its influence as a so-called neutralizing medium of "acidity" of the mouth is practically nil. As the quality of saliva when collected during active digestion is always an expression of the nature of the last meal taken, saliva intended for analysis should be collected during resting hours of the digestive apparatus. The normal, healthy grown individual produces during waking hours approximately 1 c. c. of saliva per minute. During mastication, as stated above, depending upon the nature of the food-stuff, this amount may be greatly increased.

Pickerill has made the assertion that the principal function of saliva consists in the hydrolysis of starches and thus prevents dental caries. The writer has not been able experimentally in the human mouth to show any relationship between the amylase (ptyalin) content of saliva and dental caries. Amylase may be readily paralyzed or accelerated by many chemic agents. Pure amylase is inactive as a ferment; certain inorganic ions, especially the chlorin ion (sodium chlorid), accelerates its activity ten times or more. Normal quantities, or even relatively large quantities of amylase may be, and occasionally are, present in the most rampant forms of caries. In certain animals, as for instance in the domestic dog, very little or no amylase is present in the saliva, although the dog is relatively immune to dental caries.

Saliva not Bactericidal.

The much discussed bactericidal action of the saliva, which is claimed to be due to the presence of small and very variable quantities of potassium sulphocyanid, has been disproved by the classic researches of Miller, Bruylant, Gies and Kahn, and Kantorowicz. In a recent paper, McGehee attempts to revive the influence of sulphocyanids in its relation to the causation of dental caries, and, as a proof, he hypothetically quotes from Pauli's interesting little work: *"Physical Chemistry in the Service of Medicine."* McGehee has wholly missed his point. Dental caries does not depend on the living organism, and, as a consequence, the presence or absence of this chemical in metabolic processes as related to dental caries plays no part. In the normal mouth pathogenic micro-organisms are usually less virulent, and they are the subordinates of the saprophytic types. Flüegge has shown that the pathogenic bacteria will become extremely active if the individual is afflicted with a slight local disturbance—as a simple catarrh of the throat. Claermont has expressed similar views, and, after a careful study of the fluids of the mouth, he asserts that one is not justified in stating that saliva possesses any definite bactericidal action. It seems, however, that the parotid saliva of man and of some animals (especially the goat) exercises an inhibitory function on certain micro-organisms—the staphylococci and the streptococci.

Very recently an hypothesis relative to definite defensive or protective organisms possessed or produced by nature to combat the ravages of dental caries has been promulgated by McGehee. This conception is based on the ingenious experimental researches of Abderhalden, who holds the view that diseased processes are primarily regulated by defensive ferments. McGehee's conception is based on a misinterpretation of the Abderhalden theory. As we have stated above and wish to state again, dental caries is not a disease; it is a process of putrefaction, which may occur in a tooth, whether this tooth forms a part of the anatomy as a whole, or whether it is detached therefrom. The writer, two years ago, while working on this very question in Abderhalden's former laboratory at the University of Berlin, convinced himself of the fact that defensive ferments, in the sense of Abderhalden's protective theory, play no part in the process of dental caries.

The fermentative changes of the various types of saccharids into soluble sugars, the mechanical washing away of accumulated food débris, and the ability of biologically inhibiting the virulence of pathogenic bacteria, are the important functions performed by a freely flowing saliva, and thereby maintain the physiologic equilibrium of the oral cavity.

Immunity to Dental Caries.

Immunity to dental decay, in the writer's opinion, depends—*caeteris paribus*—first, on a tooth free from imperfections of calcification, and, second, in a freely flowing saliva.

Immunity as referred to tooth structure is, in the strict sense of the word, a misnomer, as it is not bound up with vital phenomena. In a biologic sense, immunity indicates a state in which the "living" body resists disease. In a pulpless tooth, it goes without saying that we are dealing with dead structures as far as the enamel is concerned, and it is this latter tissue only that concerns us in the elucidation of the question: "Why do teeth decay?" In a tooth with a vital pulp, the writer holds the view that enamel is capable of carrying on metabolic processes to a limited degree. He is able to substantiate this claim by certain pharmacologic reactions, which, however, he cannot discuss at this moment. The surface of so-called living enamel he regards practically as dead structure which offers no vital resistance to the physico-chemic process of decay. The omnipresent surface colloids and the colloidal fluids present in the enamel in teeth with living pulps modify the process of decay. All teeth which are imperfectly calcified on account of their lowered resistance will sooner or later decay until relative immunity is established in accordance with the imperative law of, "survival of the fittest." If, however, the flow of saliva is impaired or completely checked, all teeth will be destroyed by caries unless some other means for the removal of food débris is established. The rapidity of the destructive processes is proportionally dependent upon the severity of the impairment. Normally, the flow of saliva is regulated by the intensity of the irritant as evinced during mastication. The stimulation by acids is of a temporary nature only, and of less importance. Therefore, vigorous mastication, or, as it is called by a recently popularized term, Fletcherizing, of correctly selected foodstuffs forms the basis for the natural prevention of dental decay.

Influence of Saliva.

To substantiate our contention relative to the position which saliva occupies in the prevention of caries, we may cite a few examples. In xerostomia, i.. e., inhibition of secretion of saliva, the teeth will begin to crumble away with the onset of the dry mouth. During other temporary pathologic disturbances of glandular activity, i. e., continuous fevers (typhoid), menopause, diabetes, etc., clinically a marked increase of dental caries is always observed. The change of environments of food supply, i. e., if the natural struggle for existence in gathering food is supplanted by artificially furnished food of a prepared type, a marked preponderance of dental caries, even in hitherto immune herbivorous animals, is always observed, as, for instance, in monkeys in captivity. The skulls of wild horses very rarely show carious defects; the domesticated horse is in frequent need of the veterinary dentist. Subjecting wild tribes of the human race to the influences of civilization, and, as a sequence, changed food supplies will always be followed by a most marked increase in dental caries. Immigrants from countries where hard-baked, black bread forms a large part of their staple diet, when coming to the United States are frequently subjected to intense ravages of dental decay. For instance, newly arrived Scandinavians, accustomed to chewing "knackebrod," forget to masticate our soft wheat bread, and, as they are often forgetful of the blessings of the tooth brush, rampant decay is frequently manifest within a few months after landing. Dental caries is comparatively rarely observed in the teeth of habitual tobacco chewers. Miller and others have demonstrated that tobacco juice possesses no antiseptic action. Its prophylactic effect, as far as the teeth are concerned, rests with the pharmacologic action of tobacco, i. e., its alkaloid, nicotin, is a powerful salivary stimulant.

In a recent communication (*Dental Cosmos,* 1913, p. 1081), Pickerill tentatively admits the importance of the quantity of salivary secretion. He states: I would even suggest that caries of the teeth may be regarded as a symptom of failure of the nervous mechanism controlling salivary secretions to functionate normally. In the writer's opinion, the quantity of the secreted saliva is the sole factor which governs environmental phenomena concerning tooth decay.

Artificial Aids to Prophylaxis.

The quantity and, to a less extent, the quality of saliva, on account of our present methods of preparing and selecting foodstuffs and the consequent insufficient mastication, are frequently inadequate to bring about a proper physiologic cleansing of the oral cavity. To assist nature, suitable mechanical and chemical means may be employed to overcome this deficiency. The mechanical cleansing of the mouth and teeth by means of the brush, powder, paste, toothpick, floss silk, etc., constitutes the absolute fundamental principle of artificial oral hygiene. Food remnants and slimy adhesions beween and upon the teeth, together with a large number of the adherent bacteria, are principally removed by mechanical cleansing.

Requirements in Dentifrices.

The mechanical cleansing of the oral cavity by these enumerated means may, however, be materially assisted by the judicious use of suitable mild astringent and indifferent antiseptic solutions. Powders, pastes, and washes containing soluble drugs, or drugs in solution, are employed for the avowed purposes of assisting nature in accomplishing the desired means to an end, i. e., they must favor the recovery of an inflamed mucous membrane, and they must mechanically remove accumulated food débris.

A good oral preparation should possess the following properties:

(1) It must be absolutely indifferennt in regard to:
  (a) the mucous membrane—non-caustic.
  (b) the teeth—non-decalcifying (mechanical or chemical.).
  (c) the organism as a whole—non-poisonous.

(2) It must not interfere with the normal physiologic cleansing of that oral cavity, i. e.;
  (a) it must not inhibit the secretion of saliva;
  (b) it must not perceptibly alter the reaction of saliva;
  (c) it must not destroy the ferments of saliva.

(3) It must possess sufficient cleansing action, combined with

(4) Good taste and odor.

These various enumerated properties are naturally rarely found in combination in a single oral preparation, and yet each one is of great importance.

Hygienic measures as applied to the oral cavity are practiced in proportion to the pleasant sensation which they call forth, hence, a mouth preparation which has a disgusting taste is ineffective because it will not be employed for any length of time by the laity. The great mass of the public will never be induced to practice oral hygiene that involves ill-tasting preparations. As stated above, mouth preparations must be absolutely free from danger as far as the mucous membrane, the teeth and the organism as a whole is concerned. Hence, Roese's dictum should be indelibly fixed in the mind of every dental and medical practitioner: "The importance of oral antisepsis is not so great that we are justified in assuming the slightest risk." This statement cannot be emphasized too strongly in view of the fact that numberless mouth washes and tooth preparations of questionable character are continuously forced on the market. Unless the correct composition of a ready-made mouth or tooth preparation is known, it should not be recommended.

The majority of the so-called dental preparations which are employed by the laity for daily use belong to a group of medicinal compounds generically known as proprietary preparations. As these compounds are not used for the avowed purpose of curing a specific disease, but rather as hygienic measures, no objection can be raised from an ethical point of view, provided that they are prepared from approved formulas and that they conform to the claims as outlined above.

A few of the more widely advertised preparations which are apparently universally recommended by the profession deserve special notice. Bad taste and general unfitness for the purpose in view are the lesser evils of most of these preparations; some are distinctly dangerous to the oral tissues when employed for daily use.

Dangers of Mouth Washes.

The conception that mouth washes, tooth powders, and pastes which, in general, are non-poisonous and neutral in reaction are indifferent to the oral tissues is erroneous. Many of these highly extolled compounds sail under dubious flags. For instance, an alkaline thymolated glycerin solution is claimed to possess extraordinary qualities as an oral antiseptic, while, in reality, it is about equally effective as a physiologic salt solution, but with a less pleasant taste. A 50 per cent. potassium chlorate tooth paste at one time furnished "nature's antiseptic—free oxygen—which whitens the teeth," and, while at present it cures "acid mouth," no trace of free oxygen was ever obtained from the use of this paste. The distinctive danger of potassium chlorate to the general health is, of course, not mentioned. Again, a mentholated salol solution is much lauded as "the most persistent oral antiseptic." This compound is rather prone to produce persistent eczematous eruptions about the corners of the mouth. Most of the widely advertised tooth powders, pastes, and certain mouth washes contain too high percentages of soap. Soap, on account of its *alkalinity,* invariably kills the important salivary ferments. The list of ill-constructed mouth preparations may be extended *ad libitum.* In spite of the absurd claims made by the manufacturers, it seems incomprehensible that numerous practitioners recommend such compounds to their patients. The best service that a conscientious practitioner can render to his clientele is to absolutely prohibit the use of a mouth preparation of whose innocuousness he is not fully convinced.

Tartar Solvents.

The search for so-called tartar solvent as an addition to tooth preparations—substances which prevent or dissolve calcareous deposits about the teeth—has occupied the minds of the dental hygienists for some time past. The chemical nature of the oral calculus indicates that the logical solvent should be an acid, or an acid salt. For plausible reasons, such substances cannot be utilized in the mouth with impunity. It is known, however, that certain alkalies—the salines—prevent the ready formation of calculus, and they help to remove fresh deposits when brought in intimate contact therewith. Just how much of this destruction or removal should be attributed to the mechanical scrubbing of the brush, and how much to the solvent action of the ingredients of the tooth powder or paste, is not known at present. Nevertheless, the salts of certain mineral springs, especially those of Carlsbad, are used in concentrated form for such purposes, and apparently with some success. Artificial Carlsbad salts may be incorporated into a paste with calcium carbonate and other abrasives; its only drawback is its disagreeable salty taste. Tooth pastes containing about 25 per cent. Carlsbad salt may be obtained in the market.

Antiseptic Mouth Preparations.

Innumerable experiments have been made to determine the so-called antiseptic strength of oral preparations. As a standard, the Rideal-Walker phenol coefficient or some other laboratory standard is usually employed as a means of arriving at some tangible conclusions. If these experiments are carried out in test tubes with cultures of isolated organisms, comparative deductions drawn from such tests are wholly unwarranted as they do not portray actual conditions existing in the oral cavity because the very premises upon which these experiments are based are erroneously chosen. On the other hand, if these preparations are tested directly in the mouths of normal individuals, it is invariably found that, in average, only 50 per cent. of the oral bacterial flora is inhibited. Authorities agree that it is impossible to render the oral cavity sterile, even for a short period only, with any of the so-far known antiseptic solutions (pastes, powders, etc., must enter into solution if any antiseptic effect is to be expected) in the strength in which these solutions can be employed with safety. The dilution of these preparations and the short time allowed for their action in the oral cavity as actually employed by the user, necessarily minimizes their antiseptic effect to such an extent as to practically render the solutions inert.

Acid Mouth Washes Ineffectual.

Recently, Gies has advocated diluted vinegar and Pickerill a solution of acid potassium tartrate as being most efficacious mouth washes. Both recommendations are based on observations made in the laboratory; their correctness is not substantiated by clinical evidence. The recommendation of an acid mouth wash of the above type is based on wrong premises because, first, the laity will not be induced to employ an ill-tasting mouth wash for any length of time, and, second, the pharmacologic principle evolved in the selection of such solutions is erroneously applied. When an acid mouth wash in the form of vinegar or acid potassium tartrate is taken in the mouth, a temporary copious flow of alkaline saliva, rich in mucin, is produced. This alkaline saliva serves as a diluent and neutralizer of the acid and the colloidal mucin acts as a protector of the insulted mucous membrane and the teeth—nature's method of getting rid of the irritant.

In accordance with Heidenhain's law, forcible stimulation of salivary glands is followed by impairment of their function. Incidentally, the acidity of these solutions kills the important salivary ferments.

Lime Water Beneficial.

It has been repeatedly shown, that a physiologic salt solution (approximately one drachm of sodium chlorid to a pint of boiled water) heated to a body temperature, reduces the oral flora by 50 per cent. and, incidentally, it is absolutely safe. On the other hand clinical evidence seems to point to the beneficial effects which are obtained by the use of such mild alkaline astringents as well diluted lime water. E. Kells, Jr., Kirk, and many other observers have repeatedly called attention to the remarkably good results obtained by its continuous use. Its therapeutic effect depends on its solvent power of the mucin deposits on and about the teeth, which mechanically retain food débris and bacteria and on the formation of insoluble soaps with fatty acids and lipoid substances. Incidentally, the freshly precipitated calcium carbonate may possibly exert some mechanical protective influences on the teeth themselves. When employed in proper dilutions, its mild astringent effect favors the recovery of inflamed mucous surfaces which, to a mild degree, are almost universally present in the mouths of most persons. A tablespoonful (one-half ounce) of lime water added to a tumblerful (eight ounces) of physiologic salt solution makes a most serviceable mixture which may be used as a mouth wash with impunity. Incidentally, this solution corresponds more closely to an artificial saliva—nature's protector of the teeth, than any other mouth wash found in the market.

Conclusions.

The writer has made innumerable tests with the various dental preparations as found in the market and with experimental mixtures, by plating out specific quantities used within specific times in the oral cavity and counting the number of colonies before and after these tests. These experiments merely verify what has been stated above, namely:

I. Sterilization of the oral cavity with any of the commercial dental preparations or any antiseptic, in the strength in which it can be employed with safety, cannot be accomplished.

2. The cleansing of the oral cavity with an antiseptic solution alone or combined with the mechanical effects of the tooth brush, powder, or paste, reduces the number of oral bacteria approximately about 50 per cent. The claims made for the antiseptic strength of certain commercial preparations are, by actual tests, wholly unwarranted.

3. A physiologic salt solution of body temperature in conjunction with the tooth brush and precipitated calcium carbonate in the form of a powder or a paste (providing these preparations are in comformity with the claims as outlined above) is the safest and most efficient of all so far known, artificial, oral hygienic measures.

Discussion on the Papers of Drs. Prinz and Lippmann.

Dr. H. Prinz, Philadelphia. Dr. Lippmann has set forth the causes which are predisposing to dental caries. There is no question in my mind, and in his mind apparently, that the sole factor of a boy's health, so far as the teeth themselves are concerned, is the underlying factor in regard to the so-called predisposition of these particular teeth to decay. Remember, there is one important fact, that the teeth as such have no bearing upon the anatomy as a whole. Decay of the teeth is not a disease in the true sense of the word, as we understand it, and from a general biological point of view. A tooth, whether it is taken as a whole, or removed and attached to a rubber plate as an artificial substitute in this particular mouth, will always decay. It contains caries from its predisposition. Therefore, internal medication for the purpose of overcoming or limiting so-called predisposition to caries is useless. It is nonsense. It has no bearing on the subject whatsoever. It is solely a question of diet. Naturally the protection of the cavity rests upon the quantity of saliva, and the quantity of saliva, as Dr. Lippmann has shown distinctly, depends upon the physiologic processes of mastication. Saliva as such, from the viewpoint of the biologist, is not a question of alkaline or acid fluid which preserves or destroys the teeth. The quantity of saliva produced and its chemical reaction are due to the fact that the nutrition which we put inside of our patients calls for that specific reaction that we find. Certain foodstuffs do not call for the production of saliva at all. To re-establish, for instance, an artificial salivary fistula, we feed an animal such things as milk, and no increase of saliva occurs. On the other hand, if you put into its mouth any substance which is boiling, as, for instance, ripe meat, it has a profuse flow of saliva. You must incidentally observe, you must make a comparison between animal and man when it comes to the question of saliva or any discharge of glandular substance, especially if we would have a true conception in regard to dental caries. It is stated and frequently quoted in dental circles that the dog usually does not suffer from dental caries; he suffers from pyorrhea, from loss of teeth, but as such, dental caries comparatively is rarely met with. Please understand that a dog in his makeup is totally different from the human being. He is primarily a carnivorous animal; he swallows his food. If we make an analysis of the saliva of the dog we do not find ptyalin, and some men say that ptyalin is what controls saliva. If we take a domestic dog and feed him for a week on pure carbohydrates, we find that we can produce ptyalin and amylase; that the gland which produces saliva is a kind of adaptation. It is said, there are certain kinds of decay where we meet with so-called immunity, and then again we meet with a pronounced predisposition to decay during the life cycle. We can always trace an apparent immunity or an apparent predisposition or disturbed immunity to glandular changes, to inactivity of the glands. I have mentioned the fact that in prolonged cases of typhoid fever we find a predisposition to decay of the teeth, simply because we have incidentally, glandular impairment. In the peculiar disease known as osteomalacia the teeth melt away like snow before the sun, because there is no flow of saliva. Saliva primarily protects the bony structure of the oral cavity which we refer to as the teeth. A free flow of saliva is the sequence of powerful normal mastication.

Dr. Lippmann has referred to the teeth of Maori children. He said that in a normal state there was not more than one per cent. of decay, but living under civilized conditions pronounced decay of the teeth has taken place, as is manifestly shown. This is not due to the fact that there is a difference in the makeup of the tooth structure, but it is due to the fact that the Maori child is fed on things which are contrary to its nature, contrary to what nature intended, and we find also in animals kept in captivity pronounced and distinct liability to dental caries because they live under conditions where they do not have to fight for their food. That is an important factor.

As to the therapeutic value of dental preparations, I have nothing more to say beyond what I have already said.

**Dr. B. E. Lischer,
St. Louis.**

I am frank to confess that I am unable to discuss these two able papers as I should like to discuss them, but I believe I express the sentiments of every member present when I say to the essayists that we are very thankful for their contributions to our program and for their participation in our meeting.

I merely wish to emphasize the fact that Dr. Prinz concludes that a solution of sodium chlorid and a harmless powder which will act as a mechanical cleanser are, after all, the best agents for daily use by the patient. And since he has presented his arguments so thoroughly, I feel that his seemingly simple conclusions represent considerable value and progress.

Most of the children that come to us for the treatment of their oral deformities are, as a rule, in a state of health. But we frequently meet with cases that do not respond to treatment as readily as we expect. Now I would like to ask Dr. Lippmann if some of these patients suffer, to a greater or lesser extent, from some of the conditions he has outlined for us to-day. In other words, it has often seemed to me that some of our patients ought to be under the care of a physician for the correction of some underlying condition; be that rickets, the erudative diathesis, or congenital lues.

Dr. Sullivan.

I would like to hear some remarks from Dr. Lippmann on the influence of tuberculosis and kindred diseases on dentition.

Dr. B. W. Weinberger,
New York City.

I appreciate the paper of Dr. Prinz and especially the one presented by Dr. Lippmann. Dr. Lippmann's paper only bears out some of the contentions I tried to bring before you yesterday, and among them, that there is such a thing as I pointed out in my paper expressed in general conditions. Most of the skulls which were shown were of a racchitic nature.

There is one point I am sorry Dr. Lippmann did not dwell upon, namely, the influence and the effects of internal secretions on the development of the teeth, dentition and so on. This is a question we should consider immediately. It is the one question that is causing all sorts of trouble and we have hardly realized it. We are only beginning to find out, here and there a few points that show conclusively that it is one step that we have yet to investigate. Naturally these conditions are met most often, by the men who are intimately in contact with them, and it is up to them more than it is to the men engaged in our profession to help us along in this way.

I would like to ask Dr. Lippmann what he has found in regard to internal secretions, outside of the racchitic condition, how congenital these cases are, and the possibility of these conditions being present at birth, preventing the proper nourishment of the children, due to the extreme distal relation of the mandible. If he has had any experience with any of these cases, I am sure we would all like to hear them.

Dr. G. Lippmann, St. Louis, (Closing.)

The question asked by Dr. Lischer I will answer later when I take up the questions of Dr. Weinberger. One gentleman (Dr. Sullivan) asked as to the influence of tuberculosis and kindred diseases on dentition. Dr. Prinz has answered that in speaking of typhoid fever. Whenever you have a lowering of the pulse tension you surely have a reason for the development of dental caries or dental destruction.

Reference was made to a faulty condition of the osseous system in children with rickets, and also to stories told by the mothers. To make a diagnosis of rickets in after-life, it is necessary to ask three questions. First, do you remember whether the baby perspired around the head when it slept? The mother does not think anything of that. She says "Yes." Second, at what age did the baby begin to work? Third, did dentition actually occur? If so, what teeth came in first? In what rotation did the teeth appear? If you can get those three questions answered, you can make a diagnosis in after-life of rickets. The harm done to the osseous system is shown by the knock-kneedness and bow-leggedness of the child and by the peculiar formation of the head; the brow of Jupiter, the protruding frontal bones, and a somewhat flat upper appearance of the skull will tell you that the child has rickets. Of course, rickets appears early enough in life not to do any permanent harm if it is cured. The harm done by rickets is not only done to the first teeth, but done to the permanent teeth, so that caries is one thing that occurs in the second teeth in the rickety human being, and also the malformations I spoke of; a tilting of the upper arch and a tilting of the lower arch.

We do not know the reason for rickets.

As to the question of breast-fed children. Almost all mothers can feed their babies at the breast, if they are handled correctly. There is no rule that milk must come in three days or ten days, but the milk will come if the mother is persistent. There is no difference in the quality of milk of the mother.

Dr. Prinz spoke of the use of certain therapeutic preparations and about chemical analysis. You cannot make a chemical analysis of milk percentage in the breast of a human being, because you cannot empty the mammary glands. Every farmer will tell you that the first stripping of the milk looks blue. That is always the case. The last part that is taken away from the mammary gland is the cream, so that when a doctor speaks of having a chemical analysis made of the milk you know right away it cannot be done. In the first place, much depends upon the milker of the mammary glands. The mammary gland cannot be emptied artificially. In the second place, it is not clear that it is the chemical quality of the milk that makes a difference in the feeding of the child. We have gone to the period of percentage feeding in trying to make cows' milk equal to human milk by percentage. We find we have not touched the physiological principle of it, besides the salt principle in the two milks. Breast-feeding can be instituted in almost every case, and the child that is not breast-fed is handicapped.

Internal Secretions and Rickets.

Let us now take up the question of rickets in relation to the internal secretions. As I said in my paper to-day, we do not know any reason for rickets, yet it is a peculiar condition. In England, where the milk is poor, rickets is produced by lack of fat in foods. On the Continent, where the milk is fairly rich, rickets is produced by too much carbohydrates. In America, where we have raw milk, it is produced by boiling the milk or by artificial foods. This symptom complex I called a diathesis; I did not call it a disease. It is a symptom complex we do not understand, but it may be produced by congenital disturbances of the internal secretion, and especially the secretion of the adrenal bodies and parathyroid gland. Let us go a little deeper into that, as possibly it may be interesting. I would like to say that those men engaged in your line of work in looking for congenital malocclusions and other pathological conditions should not be satisfied with taking pictures of the skull only. The question arises, is rickets a congenital predisposition, an exudative diathesis produced by imperfect secretion of the adrenals and parathyroid bodies? We must take a picture of the long bones together with the head in order to make a diagnosis.

In rickets, children who have gastric disturbance will suddenly develop spasms, or they will develop a spasm of the larynx that is accompanied by a crowing sound. The child gets blue in the face. These children are susceptible to spasms, they are rickety in all probability, and the spasm is produced by a disturbance in the parathyroid bodies and by a disturbance in the calcium metabolism. If the calcium metabolism is disturbed, and there is a disturbance in the adrenals and parathyroid bodies, we can see why the teeth should be disturbed by rickets. Besides giving phosphorus for combining the calcium, we can see why we should get results in these cases if we give children adrenalin internally and extract of the parathyroid bodies. Besides, if children susceptible to spasms are given repeated doses, they will not get a second spasm if fed calcium chlorid or calcium lactate. This may give you an idea of how to overcome early the ravages of disturbed metabolism by feeding any one of the calcium salts.

Internal Secretions and the Teeth. Another interesting question comes up here about the internal secretion, and that is a question of abnormal position of the teeth in an abnormal mandible, especially with wide intervals between the teeth and with small teeth at the same time. I have put these cases down as low myxedematous cases, where there is a lack of thyroid and these cases improve under thyroid. I did not quite understand Dr. Lischer's question.

Dr. Lischer. May not some of these children go to the orthodontist without being under the care of a physician?

Dr. Lippmann. In the first place, it is important to make a diagnosis of late rickets, which is not as rare as you think. Second, the diagnosis of very light cases of myxedema. Third, those cases that are still suffering from injudicious feeding at an older age. If you get results in your cases of malocclusion, you are fairly safe in giving small doses of thyroids to help the normal position of the teeth and normal growth with calcium metabolism. These old cases of rickets improve under thyroid, adrenalin, or calcium chlorid treatment.

Feeding. The question of feeding is a hobby of mine. Feeding in infancy has to do with the weaning period. In nature sugar never appears as such except on two occasions and that is in honey, and in the sugar-cane. Honey, of course, is not meant for food to any great extent, but sugar-cane is. A child to get sugar-cane would chew pretty hard to get a small quantity of sugar, and in getting sugar would at least produce sufficient saliva to wash the sugar down. In all our feeding we prescribe that a three-year-old child has to chew scraped beef, soft boiled eggs, mashed potatoes, vegetables, and so on. In addition, it receives gruel, porridge, nothing to eat, and the worst habit of all, besides not chewing, the child gets at the end of a meal a piece of soft candy so that it may not have its feelings hurt. (Laughter.)

Dr. Prinz mentioned food. I spoke about Swedish bread. Most of the bread is whole rye bread and if toasted besides it is a splendid means of overcoming the end of the meal.

Pres. Federspiel. I am sure the Society appreciates the kindness of Dr. Prinz and Dr. Lippmann for presenting these two splendid papers. If we keep good records, particularly of the teeth and take into consideration the systemic conditions and co-operate with the internists, we will accomplish more in the future than we have done in the past.

The Concealed Labial Arch Wire With Spring Extensions.

By Lloyd S. Lourie, D.D.S., Chicago, Ill.

It was a mistake to have my name appear on the program for a paper, as I had intented to give only a table clinic, allowing the appliance to speak for itself. Yet it does involve important principles in appliance construction, which may be worthy of discussion before the Society. I regret that my illustrations are not more comprehensive, due to the fact that they were collected after the printed program was received, and when many of my patients were away on vacations.

Loops in Arch Bows Condemned.

For best results mechanically and physiologically, force should be applied to a tooth only in the direction in which it is desirable for it to move. For that reason, appliances should be so constructed as to allow individual tooth movement, without undesirable reaction on adjoining teeth, and with the minimum of change in the reaction on anchor teeth. Dr. Angle has emphasized this point, and rightly criticized the use of spring loops, because of constantly changing direction of force. In *Dental Cosmos,* September, 1916, speaking of vertical loops (Fig. 1) in the buccal portion of arches, he says: "My criticism is that instead of the force being delivered evenly to the anchor tooth and in one direction only, as is easily possible with the screw, the direction of force is constantly changed, thus mischievously disturbing the function of the cells of the peridental membrane and the alveolar process. And this must be repeated with each change in the form of the loop."

Later he limits this criticism to vertical loops in the buccal portions of the arch, attempting to whitewash the same objections in horizontal loops in other portions of the arch, which are so extensively used in his "Pin and Tube" and "Ribbon Arch" appliance. (Figs. 2, 3 and 4.) However, I submit for your consideration the suggestion that spring loop reaction is much the same whether in the vertical or the horizontal plane. Also, that the various arch bends and twists by which force is applied in the above-mentioned applicances or any other of the same principle of force delivery, are but modified forms of spring loops and subject to the same criticism. In all of them, where several adjoining teeth are being moved, the only possibility of individual movement is in the section of arch between the adjoining teeth. The spring pressure

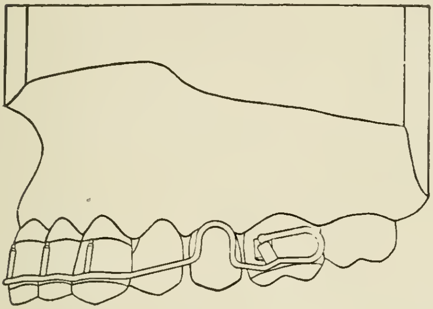
Fig. 1.

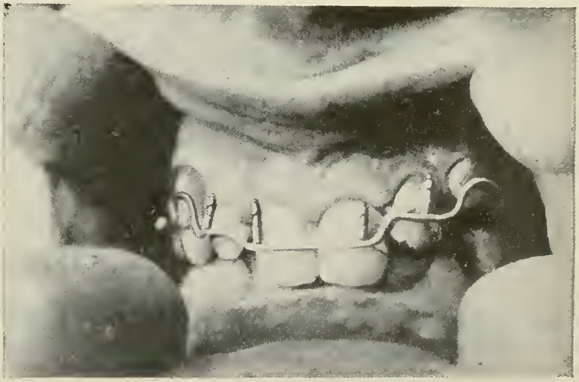
Fig. 2.

for moving one tooth must react on the adjoining teeth, before it can react on the main anchorage. Sometimes this is desirable but often a

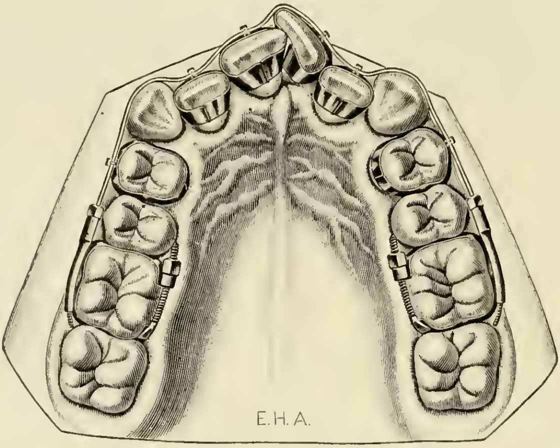

Fig. 3.

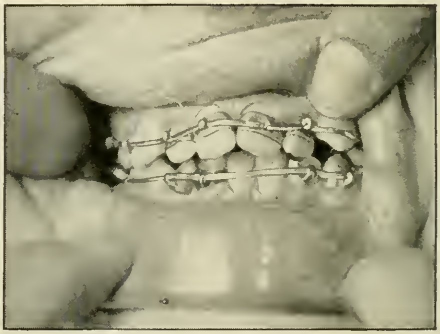

Fig. 4.

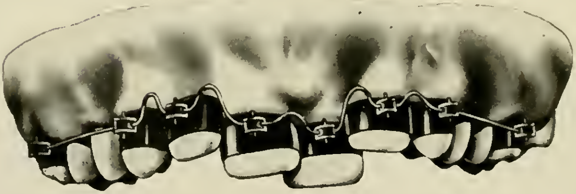

Fig. 5.

great disadvantage. Furthermore, with all thin or small gauge arches, there is increased danger of injurious changing reaction on the main anchorage by bending of the buccal portions of the arch. This may be controlled by a supplementary lingual arch. In fact, I believe it good practice to use such a lingual arch for increased stability of anchorage teeth whenever they are to be subjected to much force.

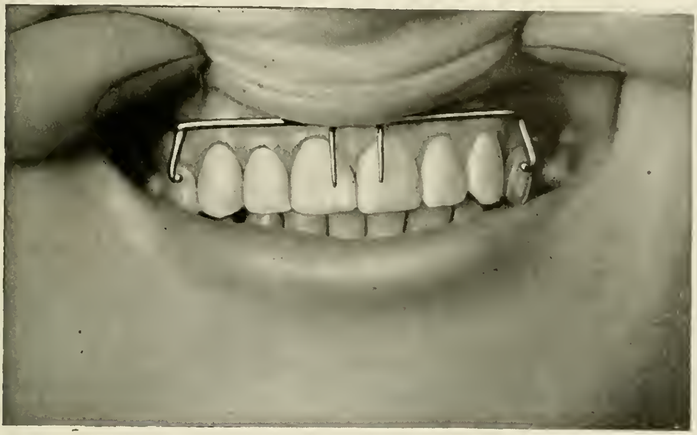

Fig. 6.

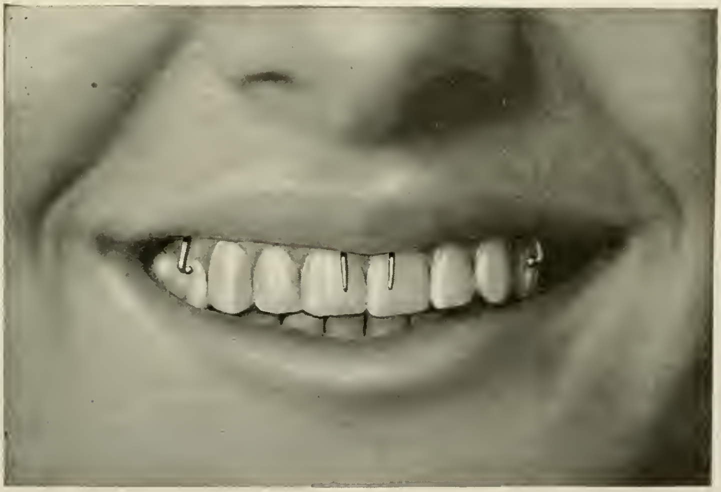

Fig. 7.

The Author's Appliance.

The appliance which I will describe is not claimed to be of universal application, nor does it "meet every hygienic and physiological need," but I believe the principle is correct. I have used it successfully in a variety of ways, and I think that its usefulness can be greatly extended.

The appliance consists of a comparatively rigid base wire (Fig. 6), preferably adjustably attached to anchor teeth, and small spring extensions for delivering force for individual tooth movement. The form of attachment of base wire to anchor teeth depends upon the requirements of the case. The base wire lies beyond the teeth gingivally, but does not touch the soft tissues underlying it, and is usually entirely hidden

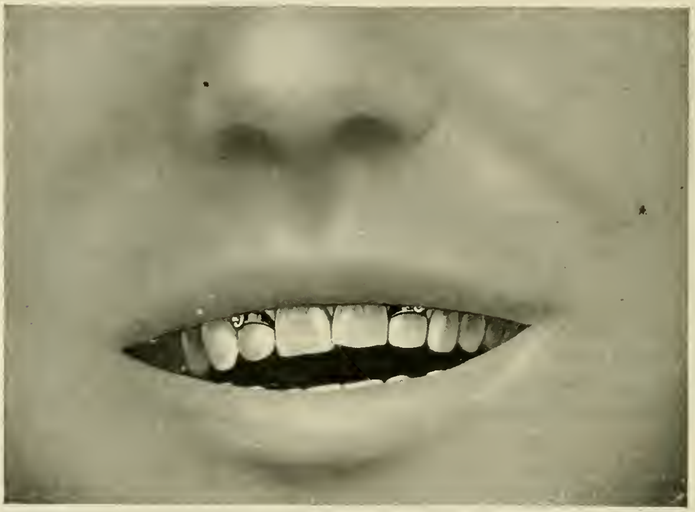

Fig. 8.

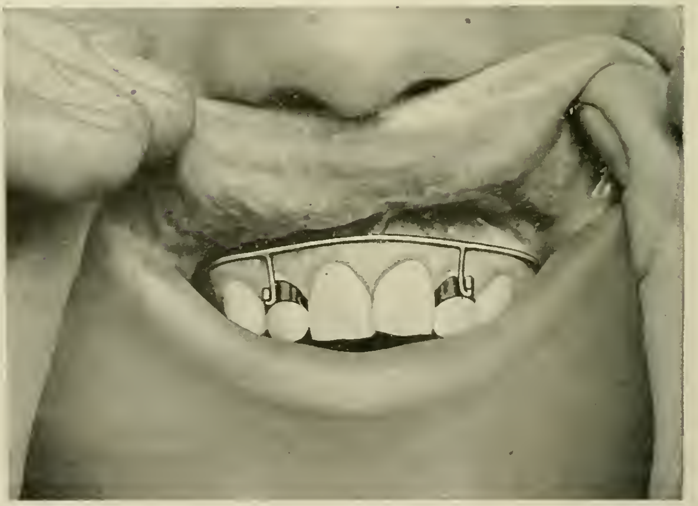

Fig. 9.

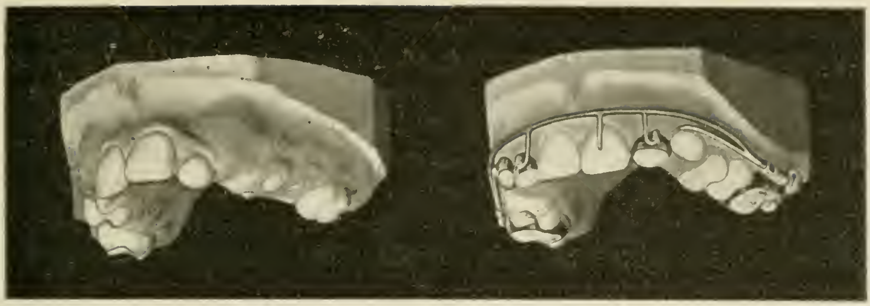

Fig. 10.

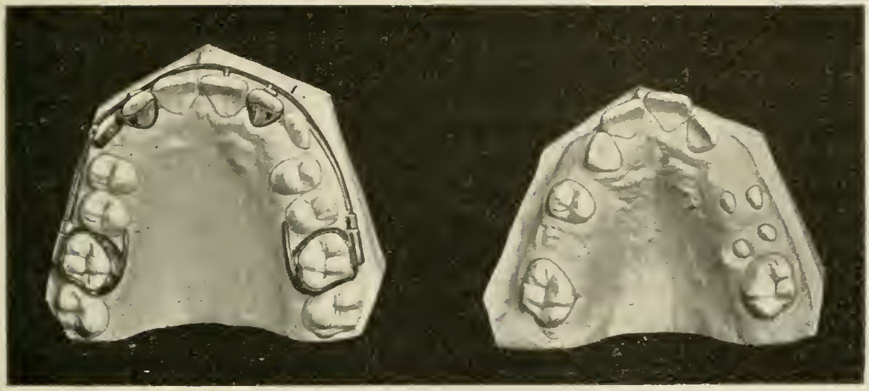

Fig. 11.

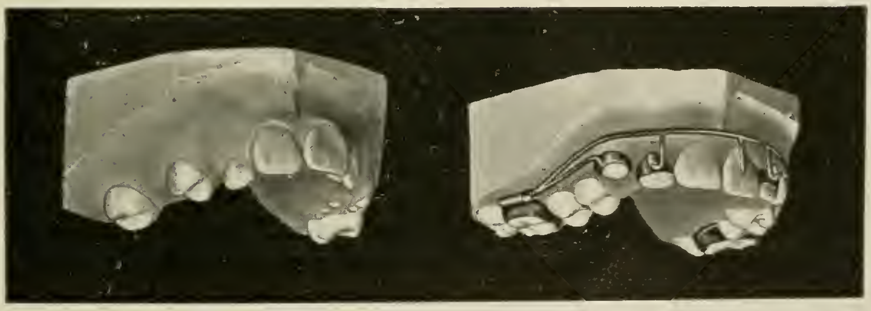

Fig. 12.

by the lip. (Fig. 7.) The springs may be of various forms and sizes, the simplest being the straight vertical one.. (Figs. 6 and 7.) This may be used to press against a tooth or to pull on it if attached by ligature, point, knob, eyelet, or incisal hook. The one possessing the most varied possibilities is the recurved vertical spring (Figs. 8 and 9), the recurved end entering a vertical tube on the banded tooth. With this spring, the tooth may be moved in any advisable direction or combination or directions, including root movement and rotation, excepting for extrusion or intrusion. (Figs. 10, 11 and 12.) These latter movements may be provided for, by adding a horizontal section close to the base wire, or by utilizing the spring of the base wire itself, if that would not react unfavorably on the other teeth being moved. The end may be locked in the tube or allowed to move freely if required. The vertical springs should be used wherever possible, for hygienic reasons (permitting use of tooth-brush and floss), and particularly in the front of the mouth for esthetic reasons, as they harmonize with the lines of approximal contact of the teeth (Fig. 7), whereas, the horizontal extensions contrast and are more conspicuous.

By using the appliance in combination with a lingual arch, in many cases teeth may be moved as desired without the use of either bands or ligatures. In fact, by applying the same principles, much can be done with the lingual arch alone, the horizontal spring extensions being more adaptable however.

In closing, let me emphasize the point that the force for individual tooth movement should be controlled in the individual spring extension, the base wire being used as anchorage for these reactions, and for movement of teeth in groups and for intentional movements of anchor teeth.

Discussion of Dr. Lourie's Paper.

Dr. Martin Dewey, Chicago.

In discussing this paper of Dr. Lourie's I can only add my support to what he has said in regard to the use of this appliance and to a certain extent call attention to some things he has mentioned regarding the deficiency of other styles of appliances.

It seems that regulating appliances have passed through evolutionary stages, and while some of the steps taken in the construction of appliances have been progressive, other steps have been backward. Any regulating appliance to be successful must possess certain requirements, and I think you will find that this appliance as used by Dr. Lourie possesses more ideal features than any other style of appliance which has been brought out.

One thing which I want to call to your attention is the question of anchorage. If you remember the dental literature of a few years ago, when the question of bodily tooth movement was featured, attention was called to the fact that we must have firm anchorage. The pin and tube appliance and ribbon arch are appliances composed of flexible alignment wires, which control both the anchorage and the moving force. As a result you are liable to have more or less trouble with the anchorage. If you take a small gauge arch, such as a ribbon arch, bend it around in the various positions it is to occupy when attached to the malposed teeth, and have it attached to all of the anterior teeth and cuspids, you do not know what kind of force you have on the molar. In using the concealed labial arch or labial alignment wire, which consists of a rigid base wire, you to a certain extent divide the appliance into two parts; your base wire becomes your anchorage and is made sufficiently rigid so that it will hold the anchor teeth against each other and one will support the other. Individual tooth movement by the individual spring extensions can be controlled. If you bend one of these individual springs, whether it is adjusted to a band or in contact with the tooth, you know you have pressure on that individual tooth. It does not affect the approximating teeth only as the force is reactive to the base wire, and as the base wire is comparatively rigid, you will have practically no reaction on the adjoining teeth. You will also have very little danger of changing the molars bucco-lingually because of the rigid base wire.

There is not very much more I can say except to call attention to some of the deficiencies in other styles of appliances and to some of the advantages which he has passed over and has not impressed upon you sufficiently. You take any style of appliance with a small gauge arch and rigid attachments and make an adjustment from lateral to central and over the cuspid and around the molar, and in attempting to change the shape of the alignment wire you get so many reactions that you do not know what is happening to the molar. These reactions are absolutely impossible for the average man to figure out. Where you have the teeth attached rigidly; you cannot adjust the appliance on the central incisor without reacting on the lateral. With the pin and tube the pin is so short that you lose the elasticity of the pin, or the elasticity is interfered with in the alignment wire. That means you have torsion force exerted on the central which will be reacting on the lateral and vice versa.

From the hygienic standpoint, the advantage of the concealed labial arch is easily seen. We can use a tooth brush successfully or floss silk. With the ribbon arch you have great trouble in making adjustments because of the impossibility of bending the flat wire with any degree of certainty. It is difficult to make a bend except in one direction of thickness of the metal. In making the bend in the occluso-gingival direction you have one thickness; bucco-lingually you have another thickness; in trying to combine the two bends you have great difficulty. I do not believe anyone can make those bends so that force will be accurately distributed. Dr. Lourie has called our attention to the fact that the base wire must be placed gingivally, but he did not mention the height at which it should be placed. You are governed by the attachments of the lip. Of course, the higher you have it placed, the longer the spring will be in the molar and premolar region. The height will have to be governed by the attachment of the anterior portion of the buccinator muscle or the posterior portion of the *levator labii superioris*. As a result of that, the wire must not be so high as to interfere with the attachment of the lip. In some cases where the frenum is low, you make a loop to escape the frenum.

One of the most important features to remember in connection with the application of this appliance is from the standpoint of esthetics. We find that patients will wear any kind of appliance at first, but after a while they begin to object to the appliance on account of its being so conspicuous, and if the appliance is inconspicuous we will have less trouble. A youngster who wears a conspicuous appliance is not only annoyed himself, but he annoys his parents and friends. People get tired of seeing his mouth full of bands and conspicuous material. These spurs or spring extensions are almost invisible and contain such a small amount of material that they can be used to great advantage as retaining appliances. In a great many instances, after you get a case treated and the teeth moved, it is hard to devise a retaining appliance which is less conspicuous and has less material than the regulating appliance you have on. That is a great advantage because we are not always able to retain teeth at the time we would like. The child says, "I am leaving for a vacation." You cannot change the appliance, but if you have a labial arch with spurs he can go, because your regulating appliance is also a retaining appliance. It saves a great amount of time, and it is a source of great satisfaction in a large orthodontic practice.

Finally, I honestly believe there is no other appliance which possesses so many desirable features, both from a mechanical and esthetic standpoint, as this appliance does. The patient derives great comfort and satisfaction in wearing it, and as compared with some others it will compensate you for the extra technique necessary in constructing it. I thank you.

Dr. W. H. Ellis, Buffalo. When Dr. Lourie speaks we always get something good, and to-day is no exception. His introduction on the subject of dynamics is very clear and the observations correct. In my opinion, however, we still have use for spring loops in many cases. I find them of advantage, particularly in appliances designed for the development of deciduous arches. I agree with the essayist when he says that "spring loop reaction is much the same, whether in the vertical or the horizontal plane."

It seems to me, that the contraindicated and unexpected reactions can usually be eliminated and that the results justify their use. This involves, of course, very careful predetermination of the form and extent of the loop bends, so as to place the force in only the desired direction. The arch wire should be of fine gauge and only a minimum amount of pressure exerted at each change; only such an amount as will stimulate a normal development.

Dr. Lourie has indeed given us a valuable appliance, particularly so for esthetic reasons and because of its efficiency. It is an appliance we will all gladly make much use of.

The thought comes to me that the position of the arch wire farther up under the lip will be likely to cause less distortion of the lip than the usual position at the gingival margin.

This appliance shows us that we are rapidly approaching the ideal technique, one that is esthetic, inconspicuous and simple. This appliance exerts gentle force only where indicated, and, at the same time, allows for that individual tooth movement so necessary physiologically.

Dr. G. W. Grieve, Toronto, Ontario. I would like to suggest that Dr. Lourie, when he closes the discussion, give us some idea of the technique of construction of these labial and lingual arches, and a clearer description, if possible, as to the position of the lingual wire and the extensions.

I certainly have appreciated very much the presentation of this subject by Dr. Lourie. I have had the pleasure of getting nice results from the use of the lingual arch, not fixed as Dr. Lourie uses it, but as a removable appliance. My assistant makes a sketch of the arch each time it is removed, and the changes are then made "out of the mouth" and I am able to "check up" by means of the sketch.

Dr. Calvin S. Case, Chicago. One of the most encouraging things that comes to my mind in regard to the presentation of these two papers that we have listened to this morning is the fact that we are not confining ourselves to any one single method; that he are willing to accept other methods. Another thing is it leaves every orthodontist to do a great deal of the work himself, so that he can apply the forces and make those changes in variation that are especially adapted to the particular cases in hand.

I have been somewhat acquainted with Dr. Robinson's method for some time and have thought a great deal of it. I think it very valuable, but, of course, it will not do for all cases. I am now very much pleased to hear Dr. Lourie's paper and to learn more of that which he has from time to time explained to me. I consider it a very valuable method, and one that will prove to be more and more valuable in practice. It is certainly very desirable to have our appliances as inconspicuous as possible, and if the forces can be applied by this method safely and according to mechanical principle and physiological needs, it is certainly exceedingly valuable. I do not know enough about it to really discuss it at this time.

Dr. R. Ottolengui, New York City.

We have had presented to us in an altogether too abbreviated a manner a method which appears to be one of the most important that we can use, and we have had pointed out to us numerous advantages of the method, but neither the essayist nor the gentleman who first discussed the paper has pointed out the troubles that we get when using these appliances and how to overcome them. Dr. Lourie and Dr. Dewey in presenting to us the advantages of this appliance have used the same slides repeatedly and have expressed these advantages most accurately, but we find the labial surfaces of the anterior teeth are all in normal alignment. That is not a malocclusal position. There are no malpositions to those teeth. Frequently patients come to us with nearly all the teeth in torsiversion. It seems to me, we are not going to find it so easy to get away from the use of bands if we use a rigid base wire above the teeth and depend upon force exerted by a pin resting against the oblique surface of a tooth. I do not think the essayist has made it clear to us how to get rid of bands where the teeth are in malposition, and especially in torsiversion. That is more, however, in the form of a question rather than a criticism, because I think this appliance speaks for Dr. Lourie's great ability.

Dr. L. S. Lourie, Chicago.

Dr. Ottolengui's objection and Dr. Grieve's request would call for the same sort of explanation. Dr. Grieve wants a fuller explanation of what I have offered and so does Dr. Ottolengui. I am perfectly willing to go into detail in the matter if the society wishes me to do so. What I have said in this short paper has been presented by Dr. Dewey in the form of an article. I have not felt I had time to prepare a paper that would cover the technique in such great detail as I would like to present it.

Dr. Dewey mentioned the advantage of looping the base wire out across the frenum. I want to suggest that while that is an advantage, if there is to be any particular use of the base wire for exerting changes on the anchored teeth, there will be the same objections that I have made of other loops. So I believe the fewer bends and loops you have in the base wire the better. If it is for a patient who has a short upper lip, the appliance can be put where the patient does not use the lip in spite of the objection to it. That applies in a great many ways. No appliance fills every need. When we select what we think is best for a case in hand, it is a compromise. We select an appliance that has the greatest number of advantages and fewest disadvantages.

As to retention, Dr. Dewey mentioned leaving the appliance and merging it into a retainer. That would call for further elaboration as asked for by Dr. Grieve and Dr. Ottolengui.

Dr. Ellis says he still has use for spring loops, and I have no doubt he will use them at times.

In regard to the remarks of Dr. Case, it is a good sign when we are all willing to accept other men's ideas, and admit that whatever ideas we have are not the last word and cannot be improved upon as some have been prone to advise.

Dr. Ottolengui. Can you handle teeth in torsiversion without bands?

Dr. Lourie. I can correct teeth in torsiversion. Sometimes I can, but in a great many cases I cannot do so without bands. It depends to some extent upon the shape of the teeth. Take a tooth that has broad, flat surfaces, where I can get the labial extension far enough off the sound tooth to get leverage and fulcrum formed by the lingual appliance, and I can correct it. You get rotation in a great many cases with the lingual arch and with the extension, or when it is in contact with the labial arch with the extension; I prefer the extension on the labial arch.

Dr. Ottolengui. In conjunction with the lingual arch?

Dr. Lourie. Yes. I do not correct torsiversion of the teeth with plain bands. You can get a certain amount of it; you can get quite a bit sometimes. As I have said, my first choice is a lingual arch; my second choice is a combination of the lingual and labial arch without bands, and my third choice is a combination of all three, for I get quicker results with less frequent appointments, and I have more certain control over my work.

In a particular case shown here, I started the treatment with the lingual arch, but discontinued it, the child having considerable defect in speech, and the mother was inclined to believe, as most people would naturally, that the lingual bar had something to do with it or prevented its correction. My experience with lingual bars is, that if they are placed right and allowed to lie in the rugæ of the mouth, they do not interfere with speech. I would have continued with the lingual appliance, but I decided I would not put myself in a position of being criticized for in any way preventing that child from developing correct enunciation. So I adopted this labial appliance. I could have accomplished rotation of the laterals, carrying them out to normal position, with root movement by a combination of labial and lingual arches without the use of any bands. I am presenting this labial arch with recurved spring extensions because I believe it will require less skill and careful adjustment to accomplish results than the use of the combination of arches. There is nothing patented about it, and you have perfect liberty to modify and amplify it to suit your individual needs.

Dr. Case. Will you explain the intruding and extruding forces, acting on a portion of a tooth?

Dr. Courie. There is one illustration which shows a cuspid being extruded (see Fig. 12).

Dr. Case. There is a band with a horizontal spring. You must have force directing in that way to correct the alignment of the teeth.

Dr. Courie. Yes. Dr. Ellis has suggested that arches placed as these are placed would interfere less with the lip. I have tested this out by clinical experience and find patients do not object to it. An arch placed across the teeth is where the tip of the lip is moving and it is in the way. Some patients who have changed from the old one say, "I don't care how long I have to wear the new one, it does not bother my lip." In cases where there was a deficiency in the function of the upper lip, I have taken off the labial arch to test retention and mothers have said, "I wish you would put that back, for the lip was held down better with it on." If the arch is across the teeth, in smiling, it is uncovered and the lip rests above it. When the arch is above the teeth the lip is pressing over it all the time and more easily develops normal function.

Dr. Federspiel. Is there any irritation of the epithelium of the lip?

Dr. Lourie. I have not had any. That is another reason for not making the base wire too small. If you make it too small, the lip falls in over it and irritation results. You must be careful how it is adjusted. If it is allowed to extend out from the gum at any particular place, you are bound to have lip irritation. As I have mentioned, this must be adjusted so that it does not come in contact with the soft tissues underlying, otherwise you occasionally have some pressure on the soft tissues; and you must adjust it to allow for changes due to erupting teeth, particularly the cuspids. If you are not particularly watchful, the gum will press up against the base wire and you will have trouble.

Dr. Ottolengui. Is the appliance removable?

Dr. Lourie. Yes. The labial base wire is removable. The attachment is a horizontal tube with the nut in order to adjust it mesio-distally. It is possible to use plain wire, bend it at right angles upward and forward and get more or less mesio-distal adjustment in the buccal portion of the arch, but you have to make compensating bends, and each bend affects the fit of the labial portion of the arch.

Dr. Grieve. Does the horizontal tube have a nut at the distal, as well as at the mesial end?

Dr. Lourie. No, I use a horizontal tube with a nut at the mesial end, and a silk ligature tied in front of the nut and distal to the tube. My reason for that is as follows: I tell my patients, with the utmost confidence that they do not need to have sore teeth; that soreness is an indication that I have not my appliance under control. If I cannot get the appliance under control in the first adjustment, I can generally do so in the second. The teeth may be a little sore because they have not become accustomed to the pressure, and I would rather make use of an appliance that can be removed by the patient, if necessary, than have the patient spend a night with sore teeth. If one of these extensions should get broken off or bent at any place, there might be undesirable pressure upon some of the other teeth. So I tell them that if the appliance is bent or injured in any way, I would rather have them cut the silk ligatures which I tie in front of the nut and back over the tube.

As Dr. Dewey mentioned, the use of the appliance may be continued without change for retention. However, to eliminate bands, it is necessary to use a lingual arch for a fulcrum and the labial arch with extensions to control the rotation and root movement. This may not be effective in every case, particularly if complicated by intrusion or extrusion.

Retention can be developed from a moving appliance, by removing the band and the recurved portion of the spring, which leaves a simple vertical spring extension. This may be bent, so that the end of the spring comes in contact with the most desirable point on the tooth for control. If this is not effective, all that is necessary is to replace the spring extension and band, as no change has been made in the remainder of the appliance.

After the appliance has been worn continuously for some months as a retainer, small hooks are added so that rubber bands can be used instead of silk ligatures for holding it in place. The patient may then take it out for short periods. Young ladies appreciate this privilege for special occasions. That is the first step. Then, when I think the teeth are firm enough, the labial arch may be left out during the day, provided that when it is out it is placed on a form such as I have illustrated (DENTAL ITEMS OF INTEREST, January, 1916). That is done for two purposes, one of which is to prevent the extensions from being bent while the appliance is out of the mouth, and another one is that the patient can know if it has been bent while getting it out or putting it in. It is brought in for readjustment if necessary. It is not a bad idea to have two of these forms, one in the office so that it would be less work to reconstruct the appliance of one form should be lost.

Dr. Federspiel. What prevents the molars from tipping?

Dr. Lourie. Use the same precautions to prevent straining the anchorage in this appliance as in any other. You can reinforce the molars by attaching additional teeth, as Dr. Case did in his appliance. I reinforce the molar anchorage in a great many cases with lingual arches which may have no other use, though they may be used later in combination for retention. The lingual arch is extended forward, and fastened to the bicuspids with ligatures or bands with lingual extensions to prevent tipping of the lingual arch. The lingual arch is the reinforcing lever and counteracts the tipping tendency of the labial arch.

Dr. Ottolengui. I would like to ask Dr. Lourie how he prevents the extensions from slipping up.

Dr. Lourie. I mentioned that in my original presentation. (Hooks over incisal edges if bands and tubes are not used.)

A Member. Do you use this appliance on all patients in temporary dentures?

Dr. Lourie. I do not believe in using such an extensive appliance for temporary dentures as a great many men advise, because by the time a deciduous denture is expanded, frequently the teeth and expansion will be lost anyway. It is just as important to keep a deciduous denture in good solid condition so that the child can masticate thoroughly with it, as it is to attempt to get some effect upon the permanent denture by mechanically expanding the deciduous one.

A Member. What about the other extreme?

Dr. Lourie. There are many cases in which all that is necessary to do is to expand enough to allow the incoming incisors to take their positions in the arch. Naturally widening of the rest of it will follow. My plan is to assist in developing cases where it is necessary.

A Member. What is the extreme age of patients on whom you use this appliance?

Dr. Lourie. It depends upon what you are going to undertake. The limitations of age would apply equally well to any other appliance.

It has not been my desire to give a talk on the use of the lingual arch and wire stretchers because I feel it is something I developed especially; and while I am getting results I cannot explain the details and dangers of it fully enough to warrant you in trying to extend its use. I probably would better not touch on that phase of the subject, but after I came to use the lingual arch and enlarged it with my wire stretchers, I found that was the most direct and simplest force I could use. If the pinch is made straight, it corresponds to a jackscrew, and you have the lingual arch lengthened in the direction of the portion pinched. The arch can be lengthened mesio-distally by pinching the lateral portions and can be widened buccally by pinching the incisor portion, and in many cases that is all that is necessary. There is a disadvantage, in that the action is limited, but I believe that usually I can get movement as rapidly as is advisable. I also use a lingual arch with spring extensions. The same thing applies as to the labial arch, the fewer bends and kinks you put in, the better, because of the reaction. I prefer a lingual arch that does not come in contact with the teeth or soft tissues, with spring extensions for getting movement of the teeth, later, if necessary, using a combination of lingual and labial arches for finer adjustment.

A Member. In using a lingual arch do you use a round or oval tube?

Dr. Lourie. The form of attachment depends on the case.

A Member. Do you mind saying a few words about the materials?

Dr. Courie. I have not found anything that compares with iridio-platinum for use with wire-stretching pliers. It has a compressibility and ductility together with rigidity that I have not found in any other material. The labial base wires I have used mostly, have been 17-gauge platinum gold expansion arches, with 22-gauge platinum gold for spring extensions. With this I have had more or less spring through the action of the base wire itself, because the 22-gauge spring was really so stiff, comparatively, that it reacted upon the base wire. But more recently I have used 19-gauge iridio-platinum base wires and 24-gauge platinum gold for these extensions. Where it is a plain spring and not recurving into the tube, I have tapered down the 24-gauge spring until the lower half of it was not more than 26-gauge. That is as thin as I have used it. You can use 26-gauge for recurved extensions. I have not used it because I could get only the larger tubes.

Platinum is not springy enough for the extensions. The particular grade of metal you use is important. The point is that the base wire should be comparatively rigid, while you want as great a range of spring in these little extensions as you can possibly get. If anyone can tell me of something that has more spring to it, I would be glad to hear of it.

The Indirect Method of Band Technique.

By Martin Dewey, M.D., D.D.S., Chicago, Ill.

In presenting the indirect technique of making bands for orthodontic purposes, I do so because it is my belief that in a large number of instances a more accurately fitting band can be made and can be made with much greater ease to the patient by the indirect method than if made directly over the tooth. I am aware that there are a great many operators who can make bands directly over the teeth which fit very nicely and which are perfectly satisfactory both to the operator and to the patient. Nevertheless, the fact remains that those bands which appear to be perfect, if placed upon a metal model of the same tooth could be more accurately fitted by being swaged according to the indirect method. than they do when made directly over the tooth and contoured and burnished. It is a well-known fact that any piece of metal can be more easily adapted to a surface by being swaged than it can be being burnished.

You are also more or less familiar with the arguments which go on among dentists in regard to the advisability of making inlays by the direct or indirect method and each plan has a large number of advocates. However, everything considered, we believe that a more accurate adaptation can be made by the indirect technique in orthodontic work, especially the bands on molars and premolars, than can be obtained by making the band directly over the teeth. The methods which I present to you to-day are by no means original with me as I obtained them through conversations with and observation of other men.

In making bands according to the indirect method we have the band technique which has been described by Dr. Mershon, where the band is made over the plaster tooth. This has been previously described in the *International Journal of Orthodontia.* To-day I will confine myself to the swaging of bands over metal models and will describe for you two plans of obtaining the model by the indirect method. These plans differ in that one uses a modeling compound impression with an amalgam model, while the other uses a plaster impression with a Mellott metal model.

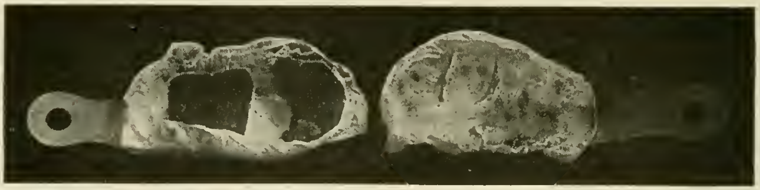

Fig. 1.—Impression for indirect band-making, showing pieces of metal between teeth and approximating teeth filled with mouldine. (Schroeder.)

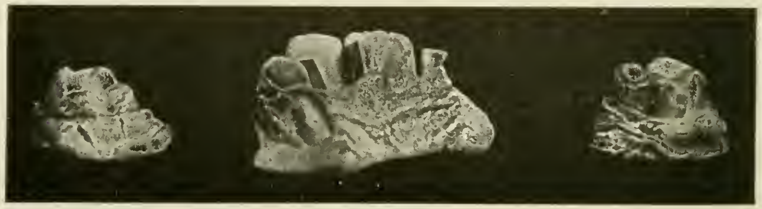

Fig. 2.—Metal models of single teeth. Models of anterior teeth made with strip of metal between teeth. (Schroeder.)

In taking a plaster impression for making a band by the indirect method, as described to me by Dr. Schroeder, we use a tray for the purpose of obtaining an impression only of the tooth that is to be banded and the approximating teeth. Before taking an impression of the tooth that is to be banded we slip two pieces of metal between the approximating teeth and then take the impression in plaster. Fig. 1 shows the impression as it is removed from the mouth with the strips of band material in between the teeth. As we desire a model only of the tooth to be banded, the impression of the approximating teeth is filled in with mouldine as is shown to the left in Fig. 1. If we desire to increase the length of the tooth it can be accomplished by carefully building a rim of mouldine around the gingival border of the impression which will increase the length of the tooth and enable us to fit the band much more accurately around the gingival margin of the tooth than we would if the gingival gum tissue was reproduced in metal. After the impression has been packed with mouldine the model is then made from Mellott's or Babbitt's metal which is shown in Fig. 2. A wire measurement is then taken of the metal tooth and a piece of band material of the proper length is cut, which can be swaged and adapted to the metal tooth. This swaging can

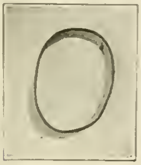
Fig. 3.—Thin copper band trimmed to festoon of gum.

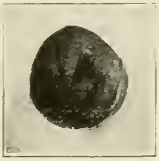
Fig. 4.—Impression of tooth in compound.

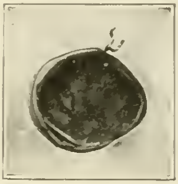
Fig. 5.—Impression with celluloid strip wrapped around it.

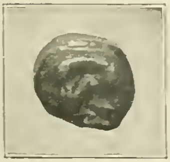
Fig. 7.—Copper amalgam model of tooth.

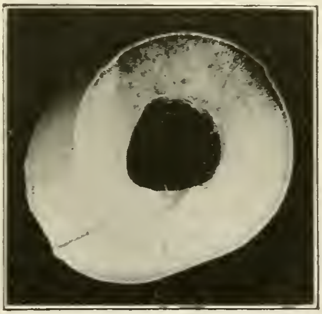
Fig. 6—Impression invested in plaster.

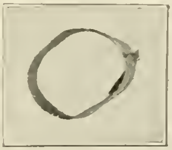
Fig. 8.—Band soldered with lap joint.

be done with a horn mallet or can be accomplished by placing the tooth and the band in a small plunger swager such as used for crowns and bridges. If it is desired to make bands upon the anterior teeth, an impression can be taken of them in the same way as an impression was taken of the molars with pieces of band material placed between the teeth. Fig. 2. If pieces of band material are placed between all the anterior teeth it may be possible to obtain a metal model of the six anterior teeth, upon which bands can be fitted.

Dr. Coston's Method.

Another method of making bands over metal models is described by Dr. Coston and I will only outline his technique briefly as he is here to speak for himself. According to this plan a copper band is made for the tooth, trimmed and festooned so as not to injure the gum. Fig. 3. This band need only fit approximately as it is to be used as an impression tray to carry the modeling compound which is to take the impression of the tooth. Fig. 4 shows the impression of the tooth in modeling compound. As we are to make an amalgam model of a tooth and desire a sufficient length of the metal tooth to be convenient for handling, a strip of celluloid is wrapped around the tooth or the impression of the tooth as is shown in Fig. 5. The impression is then invested in a plaster investing ring as shown in Fig. 6. After the impression is hard the modeling compound impression as invested in the plaster ring is packed full of copper amalgam which gives us a copper tooth as shown in Fig. 7. A piece of band material is then cut to fit around the tooth and is generally cut with the ends on the bias. The end of the band can be soldered, either pinched or lapped, but a lapped band is preferable in the swaging process. Fig. 8. The band is placed upon the metal tooth and the same placed in a swager and swaged which results in the band being properly adjusted and adapted to the tooth. Fig. 9.

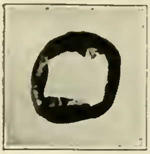

Fig. 9.—Band swedged.

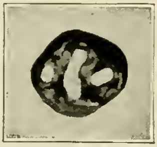

Fig. 10.—Band with cusp soldered and cut out for occlusion.

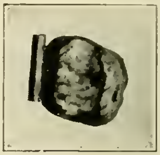

Fig. 11.—Crown with tube and lug.

Note: Figs. 3-11 were supplied by Dr. W. A. Coston, of Topeka, Kansas.*

This plan of swaging bands is especially desirable on deciduous molars, because a much more accurate fit can be obtained and because the bands can also be made with less pain and less annoyance to the patient than if made directly in the mouth. In some cases where the molars are short or the crowns are not fully calcified, it may be desirable to swage a cusp over the metal tooth for the purpose of making a band which has an occlusal surface. If this occlusal surface of the band interferes with the occlusion after the band has been cemented on it can be cut out with a stone as shown in Fig. 10. Such attachments as are necessary can be made on the band as shown in Fig. 1, which includes a buccal tube on the buccal surface of the band. It will also be observed that there is a small tube soldered on the lingual side which is for convenience in removal of the band. The swaged band fits so accurately that it is difficult to remove it from the tooth, if the band is tried on before

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*We are indebted to the *International Journal of Orthodontia* for the blocks used for illustration of this paper.—EDITOR.

being cemented. The spur is soldered on for the purpose of assisting in the removal of the band during the period the appliances are being fitted. It will be found that these bands fit much more accurately than any band which I have ever observed and we believe that the accuracy can only be appreciated by those who try them and use them in their practice.

Discussion on the Paper of Dr. Dewey.

Dr. W. A. Coston, Topeka, Kans.

I do not know that it is possible for me to add anything to what Dr. Dewey has said in regard to the making of bands. I have had a great deal of comfort and pleasure myself in making them by the indirect method, as we have had in the general practice of dentistry a great deal of comfort and benefit in the making of all restorations by the indirect method. It almost goes without saying that the making of anything to be cemented in the mouth, or to be set in that is removable in any way, can be made more definitely by the indirect method than by the direct method. Of course, many years ago we applied the indirect method in the making of all artificial dentures. We think a man is probably an extremist who would claim he can adjust a plate to the mucosa as easily as he could on a plaster or metal model, and while it is an unfair comparison, it is true of anything we make in the way of restorations in the mouth, and equally true in making anchor bands in orthodontia, provided one feels that accuracy of fit is desirable. We know it is true that all sorts of plain bands are adapted after a fashion to teeth in this work, and they seem to accomplish what we desire, but on account of the occlusal constriction of teeth, which is so noticeable in temporary molars, it is practically a physical impossibility to ever adapt a band to teeth properly and closely, working directly. The use of copper amalgam in the making of the model is purely for economic reasons. Any amalgam would do as well. In my experience there is no comparison in the accuracy of a model made by pouring metal, or by casting, with one made by forcing amalgam into an impression. The impression is made with a copper band. These bands are made in twenty sizes, from one-third to four-eighths of an inch long, very thin. They can easily be adapted to the teeth loosely. Cut away the copper on the approximal surface to accomodate the gingivæ, and make very thin approximally. In some cases it is necessary to make separation first. The modeling compound in the band is warmed and forced to place and is confined so that it cannot get away, and you get a very accurate impression of the teeth up to the gum line. By this method you can make as good an impression or better than you can with plaster-of-Paris. It is next invested in plaster-of-Paris so that you have a receptacle into which you may pack your amalgam with a good deal of force, and the copper amalgam is made thin and packed in place. The result is a practically perfect model of the tooth upon which you can fit a band with more accuracy than you can fit one in the mouth. It is especially adapted to the making of bands out of metal of all varieties of thickness. You can make them very thin so that, as Dr. Dewey says, they slip on the teeth and go quickly to place. When made of heavy material, it affords the possibility of having the band so accurately fitted in a child's mouth that it goes to place without any trouble to the child, without any pain, and to me this is a satisfaction.

Dr. C. A. Hawley, Washington, D. C. I do not know that I am in a position to discuss this paper. All I can say is that this technique seems to be altogether unnecessary. So far as fitting bands in the mouth is concerned, I think I can fit bands directly in the mouth, if I choose to do so myself, while these gentlemen are getting the impression material ready. So far as fitting a band in a child's mouth or in any mouth, where the proper separation is made beforehand, I do not see any reason whatever for using metal dies. I have a young man in my laboratory who makes bands on a plaster model. I use "snow white" plaster, and you can make a plaster model in one-fourth of the time needed for metal. There are very few of our bands that do not fit in the mouth. If these bands do not fit in the mouth to suit me, as they are made of iridio-platinum, and soldered with pure gold, I can open them and make changes while you are pouring or packing one of these indirect models of metal, or any other substance.

So far as time-saving is concerned, I do not see any advantage in it either for the laboratory man or the man at the chair. With a pair of stretching pliers and the proper metal, bands can be accurately fitted.

I do not know that I have anything more to say other than to call your attention to what I presented last year in a paper I read at Pittsburg. I have not seen any of these bands made indirectly, but you cannot use metal models, either of amalgam or low-fusing metal without stretching the band; otherwise they do not fit better than I fit bands in the mouth in one-quarter of the time. So far as an absolute fit being hard to remove, I have fitted many bands in the mouth that anyone would have hard work to pull off with an excavator. I have broken many an excavator trying to pull bands off before they were cemented in the mouth.

Dr. Coston. Of course, we know that bands can be crimped in under the gums many times so that they will stay on for an indefinite time, and very many times to the detriment of the investing tissues. The only contention I make is that bands should fit with reasonable accuracy without injury to the soft tissues. The indirect method enables one also to make a band that does not interfere in any way with the occlusion, which is impossible with a straight band, because the constriction is so great that crimping in of the ban over such a tooth leaves fissures over the lips and wrinkles, while by the swaging process there are no wrinkles.

Dr. Fisher. How long a time do you allow for making an amalgam model before you let your laboratory man work on that model?

Dr. Coston. Copper amalgam takes six or eight hours to crystallize.

Dr. Fisher. You would have to wait until the next day?

Dr. Coston. No. I simply have my laboratory man make the band so that it will fit, and whether I put my bands on to-day or to-morrow is not a matter of great importance. I would just as soon put them on to-morrow, or next week.

Dr. L. S. Lourie, Chicago. I wish to indorse Dr. Hawley's comment on this proposition, with the exception that I am willing to concede that it is advisable in many cases to make molar bands by the indirect method to save the patients more or less annoyance. However, I do believe that in making incisor bands, this is an unnecessary procedure. I am willing to undertake, and the majority of men should be willing to undertake, to fit an incisor band directly as well, if not better, than it can be fitted indirectly to a metal model. Dr. Hawley is contending that these bands can be made as well, and perhaps more expeditiously directly, than they can be made on a model. That applies particularly to the anterior teeth, and I believe the same thing might apply to the molar teeth except that they could not be made as comfortably for the patient on molar teeth, on account of interference with the cheek and gums while the band is being made.

I will ask Dr. Bowles to tell us something about an indirect method of fitting a band which is simpler than this plan, and I hope I may be pardoned for criticizing the method because what we are after is to find the most expeditious way to get the best results. I will leave it to Dr. Bowles to describe his method of fitting molar bands indirectly and getting close adjustment. If it is necessary to push metal strips between the teeth for the impressions, I can get my band measurements and have the band practically fitted in the time required for placing the metal strips. That is what takes the longest time.

So far as it's being a strain on the patient, Dr. Hawley is right, but it is not necessarily so if done carefully and properly. If a strip of metal is forced between the teeth without any previous contouring or shaping, and as high as it should go, it will extend into the interproximal tissue and give trouble. It will not only be uncomfortable to the patient, but possibly may work injury to the soft tissues. If the material is formed in a loop and the approximal edges contoured to a certain extent before it is slipped on and the approximal sides festooned, so that that portion of the band does not go too high, it is possible to put bands on without injury or inconvenience to the patient, and I would undertake to fit such bands directly, as well as anyone using the indirect method, and I could name several men who can do the same thing.

Dr. C. A. Hawley, Washington, D. C. Reference was made to Dr. Hoggan's indirect method. I was in Dr. Hoggan's office three weeks ago for another purpose, but incidentally we went over that matter. He does not use the indirect method for the purpose of saving time particularly, or for a better fit. He acknowledged to me that these bands do not fit so well as he can fit them in the mouth. He is working on cases for a general practitioner, who sends him impressions, and who wants to do orthodontia under his supervision. The practitioner sends the impression and Dr. Hoggan makes the metal model and fits the bands, and sends it back to the practitioner, and they fit well enough to do that work which could not be done in any other way.

Dr. Manly Bowles. The method I use is as follows: I make an overlapping clamp band. In some cases the ordinary clamp band that you may purchase will do; fit it on the tooth, burnish it and remove. Then solder together the overlapping ends, at the same time removing the clamp. Frequently, however, in the ordinary clamp band we find that where the clamp is soldered to the band it is flattened and widened to such an extent that it is hard to burnish the band to the tooth. I then make a clamp band having the screw portion of the clamp bent sharply at right angles and not flattened. With children I take an impression in modeling compound, obtain a cast in hard plaster and trim as described by previous speakers. I then fit and burnish my band to this model. I am not worried if the model is not absolutely accurate as the final tightening and burnishing of the band will be done in the mouth.

Further Experience With the .020 Arch-Wire

By Dr. Ray D. Robinson, Los Angeles, California.

It is well known that until recently it was common practice among orthodontists to use the 16-gauge expansion arch, and as recently as 1914, in a paper read before the National Dental Association, one of our leading orthodontists recommended the use of a 14-gauge iridio-platinum arch.

Some nine or ten years ago, a number of men at apparently about the same time reached the conclusion that they were using too much force and began reducing the size of the wire used for the expansion arches. Being familiar with this trend in thought and practice, and having before me a difficult case, I conceived the idea of using the old Ainsworth principle of retainer as a working appliance and to that end began the use of the 18-gauge iridio-platinum arch with pin and tube for the bodily movement of the molars and bicuspids when expanding the dental arch. This appliance was only used in a small percentage of cases because I did not find it applicable to the anterior teeth, and did not find the way either to lengthen or shorten an intermediate section of the arch until later years.

The next step in the development of the appliance as I now use it came in 1911 when I began experimenting with 20-gauge in the form of a looped arch. These experiments were carried on with different forms and sizes of wires and different locking devices until 1914, when I published an article under the title, *"A Looped Arch and Its Attachment,"* and later in the same year read a paper on this appliance before this Society. In May, 1915, I read a paper before the Illinois State Dental Association describing the use of the .018 tungsten wire and the .020 platinum-gold wire. In this paper was also mentioned the use of the flat wire, and in the illustrated talk which accompanied the reading of the paper a locking device was shown and reasons given why the flat wire would never, in the writer's opinion, be a success.

Success with Light Arch Bows.

As time has gone on I have found myself fully justified in the use of the smaller sized wires. It is now some three years since I have used any wire larger than .020. A proper wire of this size will develop all the force necessary to perform any movement of the teeth as rapidly as is consistent with the proper development of the bone for their support. It will not, of course, move teeth as rapidly as would the 16-gauge arch, but when the period of retention is taken into consideration the whole period of treatment and retention will average much less with the .020 wire than with the larger and more powerful appliances. The smaller wire also performs its work without the soreness which attends the use of the larger appliance, and this factor does not receive the attention which it deserves at the hands of most orthodontists. When it is stated that it is not necessary to produce soreness in correcting malocclusions of the teeth, the statement is absolutely true.

Bodily Control. The operator's control is only limited by his desires, because it is only necessary to place the block on the wire at the angle to which it is desired to move the tooth and then spring the block into its seat and lock it there. While the pressure on the tooth will be very slight it will be sufficient, if given proper time, to bring the tooth to the desired angle.

Technique. Since my last article was published I have modified the technique by changing the method of attaching the block to the wire, this now being done without soldering, by making the attachment rigid only at the arch ends by moving the arch from the buccal or labial side of the teeth to the palatal or lingual side. This has not only made the appliance less conspicuous but has greatly added to its efficiency, and has much reduced the liability of breakage. The technique of construction and application are so simple and liability of error in either direction, or amount of force is so small, that it would seem that the average man could well handle the appliance. This does not mean that any student or dentist can purchase a coil of .020 wire and immediately become an efficient orthodontist, because as has always been the case, the most important factor in orthodontia, as in any branch of the healing art, is the ability to make a proper diagnosis. By a proper diagnosis, I do not mean merely the ability to tell whether a given case belongs to Division IV of Section X, or whether or not it be a case of neutrocclusion, but I do mean the ability to look at a case of malocclusion and in the mind's eye see the changes necessary to make it normal occlusion. I mean the ability to look at the abnormal and from it visualize the normal. The work of Angle and Lischer have been of great value in assisting orthodontists in learning to make correct diagnoses. But I much fear that many depend on the letter of these classifications, and never catch the spirit of them, as in years past this same type of operator tried to make all cases conform to the size and shape of the expansion arches purchased from his dental supply house.

But, granted a proper diagnosis; and treatment should never be discussed until that is granted; the construction and application of a proper appliance with the .020 wire presents fewer difficulties to me than with any of the other forms of appliances before the profession at this time. Once the size and shape of the desired arch has been determined, it does not seem a difficult matter to construct and apply a wire arch of the length and shape necessary to bring the teeth into the desired positions. The wire is small and can be readily bent into any shape, and being small and easily sprung it can, after being formed into the size and shape of the true arch already determined, be made to assume the size and shape of the arch as it is with the teeth in malocclusion. If this be done and the wire is small and can be readily bent into any shape, and being small slowly and gently move the teeth into their correct positions. It will do this with a minimum of attention on the part of the operator and a minimum of annoyance to the patient.

In those cases in which rotations are necessary two wires are used, one on the labial and one on the lingual side, each being made to conform, in shape and size, to that portion of the true arch which it is to occupy. This, as with the Lourie appliance, obviates the spaces between the teeth made necessary by the bands in those appliances which call for a band on each tooth to be rotated.

Locks.

In the evolution of this appliance I have made and tried nearly thirty forms of locking devices. The form I now use was devised in 1914 and has been in constant use since that time, although during that period I have made and tried various other forms only to discard them. The lock is efficient. It will lock the wire and hold it rigid under the strain of moving the teeth and under the stress of mastication. It will, if properly locked, stay locked, and it can, at the operator's will, be unlocked. It can be locked and unlocked *ad infinitum*. But it matters not whether the lock devised by me to be used or some other, provided such other device will do the things which this will do. I believe some day a better lock than mine will be devised. I have clearly in my mind the requisites for a better locking device, but I have, so far, been unable to overcome the mechanical difficulties necessary to its production. I have made several forms that in the laboratory worked beautifully but when put into the mouth were failures.

The thing which I do wish to advocate is not this lock nor that lock, but the principle of the light wire; the principle of the small amount of force constantly applied as opposed to the greater force intermittently applied.

The difference in the principles of appliances as I see them can be stated as follows:

Advantages of Light over Heavy Arch Bows.

The old Angle expansion arch was a rigid appliance bent to conform to the outside of the ideal dental arch. To this rigid form the teeth were drawn by means of various forms of ligatures. The pin and tube appliance and the present ribbon arch are lighter. They may be said to be semi-rigid appliances bent to conform to the teeth as they are in malocclusion. From time to time they are removed and bent to a form more nearly resembling the true arch. The appliance which I use is a non-rigid arch made to the size and shape of the true dental arch, but of material so flexible that it can be rapidly sprung to the size and shape of the arch as it is with the teeth in malocclusion and so resilient that it will, when properly locked to the teeth, carry them toward their proper places. If we could have a wire with one hundred per cent. of resilience that is all that would be necessary, but as we have no such wire it becomes necessary to reshape the arch at intervals. Its advantage over the heavier semi-rigid appliance is, that the smaller wire can be so adjusted that it will work through a longer range of distance over a long period of time without at any time exerting more than a very slight pressure. This cannot be done with the heavier appliances, and it is this which assures that the work will continue even though the patient be away from the operator for a long period of time, and it is this same characteristic which permits great movement of teeth without the soreness which attends the use of the heavier and more violent appliances and those which are intermittent in their action.

I see those of my patients who live in my home city but once each month; those who live in other places, three or four times in a year; and in one instance the appliance was put into place and circumstances were such that the patient could not return for more than a year. Although this required a complete reshaping of both dental arches when she returned the work was found complete except that an erupting tooth has been allowed to go inside the arch wire. One adjustment of the appliance completed the work to everybody's satisfaction.

Discussion on the Paper of Dr. Robinson.

Dr. D. W. Flint, Pittsburg.

It was my pleasure to spend some time in the office of the essayist, and in discussing his paper I can vouch for what I have seen, and from what we heard last night from our friend Dr. Case, a great evolution has taken place in the sizes of wire used for arch bows. From the very large wire we have come down to the almost ridiculously small wire which Dr. Case showed us last night. There is one thing to remember, however, when talking about small wires; they cannot be used by every person because there are some people who will not take the time to study force. The smaller the wire you use, the more care you need to exert. In using small wire, if you are not watchful of its force, you will get into trouble in handling it. I have seen excellent work done by this small appliance which was a revelation to me. I have been using wires as small as 19-gauge, but I have not used them very much smaller than that. I am highly pleased in seeing what the doctor has done. At the Toronto meeting the appliance he showed to us was rather crude as compared with the one he uses to-day, and I believe the appliance he used at that time has been largely discarded by him.

Dr. C. S. Courie, Chicago. I am particularly pleased with this presentation of Dr. Robinson's efforts for two reasons, one of which is that my first choice is always a lingual appliance where I can use one that is not too complicated and which will do the work as well as a labial appliance. My reason for that is, that with a lingual appliance many times bands and ligatures can be dispensed with whereas a labial arch will require bands and ligatures to pull on the teeth.

Dr. Robinson has done a great service to orthodontia in emphasizing the point of using smaller and smaller gauge wires for moving teeth. In having a small gauge spring wire on lingually he is able to use it with more safety than where it is used labially, because he has a shorter length of wire and he has more perfect control over it for that reason.

Dr. Flint has pointed out that the smaller the wire used, and the longer the wire, the greater the danger. The more bends and modifications that are made in that wire, the more difficult it is to use it.

Another satisfaction is this: in my own paper, I found it necessary to criticize Dr. Robinson's previous appliance, along with the "pin and tube" and "ribbon arch" appliances because they work upon the same principle of more or less changing spring reaction. However, he has avoided that criticism by giving up the other appliances and adopting this one. I think that it is a very good principle and one that can be made use of if the proper care is exercised. To attempt to get an appliance which can be adjusted and used for the average case, and to say that two or three adjustments will be all that is required, is misleading. It will do much harm.

I am glad to have heard Dr. Robinson, who has had experience with all such appliances, say that he has changed his ideas.

Dr. Manly Bowles. I had the pleasure a few days ago of being in Dr. Robinson's office. He showed me a patient he had in the chair and I can vouch for the condition of the teeth. While, as he said, the case was not completed, it was progressing nicely. The teeth were moved bodily. I also saw the models where he had applied Tungsten wire. It is true he did not obtain ideal occlusion in one application, but I think that if everyone had as good occlusion as was obtained by that one application, the members of this Society would find little work to do. My own experience with Dr. Robinson's appliances has been very limited. In one case I had success; in another I did not.

Dr. Burt Abell,
Toledo, Ohio.

I would like to have Dr. Robinson tell us if he finds any difficulty in expanding the molars at the end of this light wire. It seems to me, there should be some difficulty in doing that with such light wire.

Dr. C. A. Hawley,
Washington, D. C.

There does not seem to be very much difference of opinion as to the value of lighter wire. The tendency seems to be all in that direction.

I have used one or two of Dr. Robinson's appliances. In his earlier appliance, the one he described formerly, I found the same difficulty that he and Dr. Lourie have mentioned. The attachments to be made to every tooth are all reactive forces. There is an advantage in his present appliance in the use of lighter wires. The relief from bands, it seems to me, has not been sufficiently emphasized. and is an advantage from a hygienic standpoint. I do not think anybody can fit fixed bands to the anterior teeth and avoid all irritation. It is almost impossible to get correct hygienic conditions. In the later evolution of the appliance which we see here as presented by the essayist, it is a great relief from that condition. Lingual wires that can be removed make possible some sort of ideal hygienic conditions in the mouth. They can be removed and the teeth properly cared for. If we can rotate teeth with a combination of labial and lingual wires without covering them with bands, there is a tremendous advantage not only from a hygienic standpoint, but from an esthetic point of view. Neither the patient nor the operator likes bands on teeth, and in the last two years or more there have been tremendous strides made in orthodontia in that direction.

Dr. Ray D. Robinson,
Los Angeles.

There is nothing further I have to say except to answer Dr. Abell. Why should there be any difficulty in expanding the molars? You can expand them where you will. Just as you widen your wire arch you can expand the molar or bicuspid region and expand it where you will.

Dr. Abell. Is the force enough with that light arch?

Dr. Robinson. Yes. In one case there was over half an inch expansion in the molar and bicuspid regions, so there was plenty of force. Only a tiny bit of force constantly applied will do it. If an appliance is put on to-day you cannot expect results to-morrow or next week. If you use an appliance for a period of two or three months you will get results. It is like water wearing away stones, a little force will produce it. You can expand molars or bicuspids as much as you wish.

Photo-Surveys of the Human Denture.

By Rudolph L. Hanau, Pittsburgh, Pa.
Consulting Dental Engineer.

On previous occasions, it has been my privilege to acquaint the dental profession with some of my work in dental engineering, the new science allying itself with practical orthodontia which will give it preciseness in investigation, accuracy in the interpretation of working plans, and methodical, logical, and legitimate lines of thought and work, which *must* lead to definite results, such as modern engineering demands and determines.

It is no longer necessary to point out to medical men the advantage of radiographs. They show us things which the naked eye can not discover. The same is true of orthophotographs.

Dr. Lowe J. Young in his paper, read before the First District Dental Society, S. N. Y. says:

"The first aim of a true professional should be to serve his clientele in the best possible manner."

Patients are to enjoy, primarily, the benefit of specialized training, and are given the treatment they need, which is not, necessarily, what they themselves most desire nor what suits our convenience.

If it is the practitioner's purpose to conform to the aim stated above, he can do justice to himself, to his patients, and to his profession, *only* if he keeps pace with the progress of his profession by making intelligent use of all means—educational and physical,—thereby raising his work to the highest possible standard.

Orthophotography.

It has not yet been generally acknowledged that orthophotography is one of the aids which will enable orthodontists to do more comprehensive, and consequently, better work.

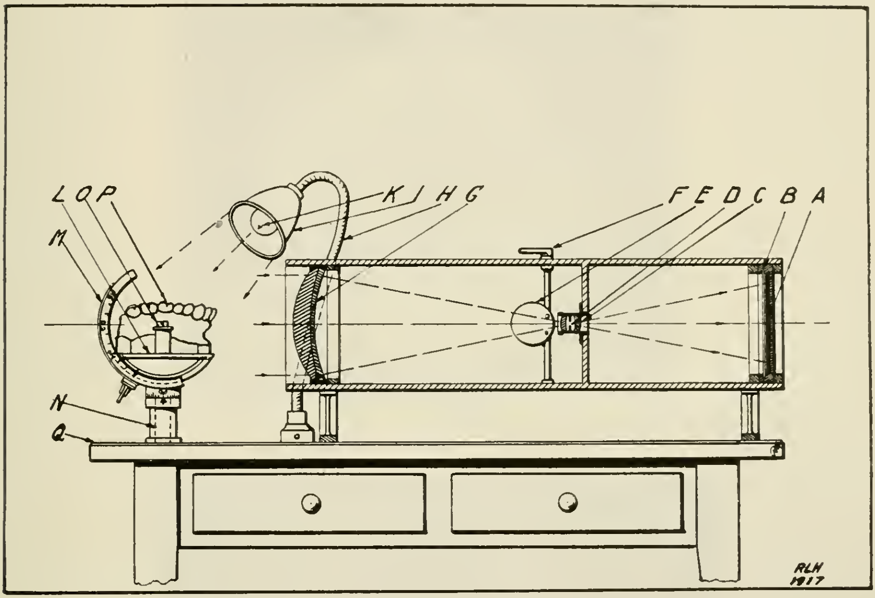


Fig. 1.

Fig. 1. Orthophotographic apparatus. A, negative plate or film in B, an ordinary plate holder; C, photographic lens combination; D, aperture; E, exposure disk; F, handle and shaft operating E; G, condenser lens combination; H, adjustable light holder (two required); I, reflector; K, light (two required; L, platform adjustable on M, segment, and N, pivot; O, vise attachment (two required) to hold P, the object to be surveyed; Q, table or board to which the entire combination may be rigidly attached.

I shall endeavor to prove that orthophotographs, or photo-surveys, as I prefer to call them, are an absolute necessity to orthodontists; as much so as are plaster casts.

The one supplements the other. Especially would I suggest that students,—and those not yet fully versed in the art of reading and using photo-surveys, should always make use of both the plaster cast and the photo-survey in their work.

The orthophotographic apparatus consists, substantially, of a photographic camera and a condenser lens, (or lens combination) placed between the camera and the object to be surveyed. The focus of the condenser should be about the center of the camera lens, so that all rays from the negative plate to the condenser are deflected by the condenser to continue in parallel rays on the object side of the condenser. The entire combination is illustrated in Fig. 1.

Figs. 2 and 3 show photo-surveys of an upper and a lower arch. Surveys made by the mechanical surveying apparatus proved impracticable to a certain degree, because their production consumes a great deal of time, and also because they are read with difficulty by orthodontists in general.

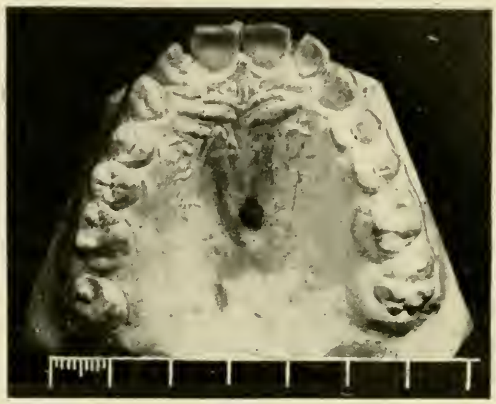


Fig. 2.

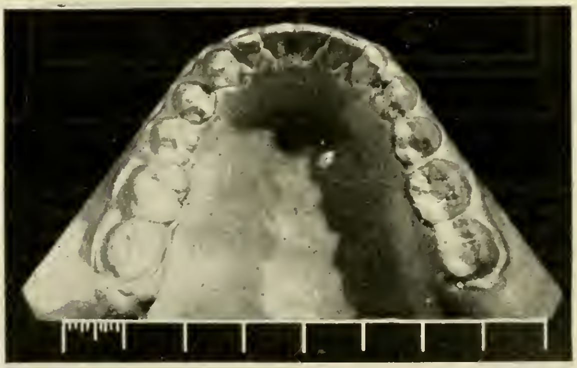
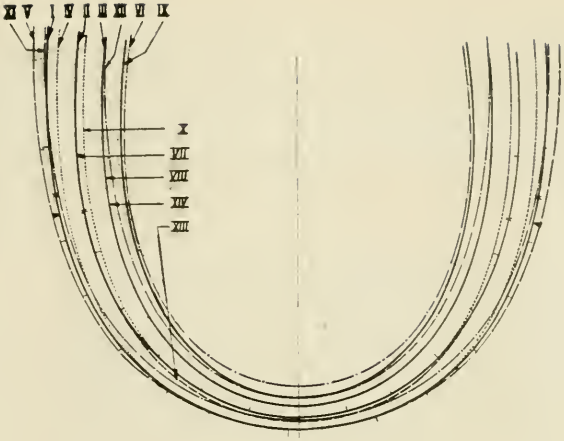


Fig. 3.

The photo-surveys (Figs. 2 and 3) picture the denture in a form familiar to all of us; photographs showing every detail,—cusps, fossæ, gum lines, etc. They possess all the advantages of a photograph, and incorporate the refined properties of the old point-method survey. Measurements at different depths of the denture may be made directly on a



DENTAL CURVES

CURVES	UPPER	LOWER
BUCCAL CUSP	I	VII
FOSSAE	II	VIII
LINGUAL CUSP	III	IX
COMPENSATING CONTACT	IV	X
OUTER GUM	V	XI
INNER GUM	VI	XII

OUTER CURVE OF OCCLUSIAL CONTACT XIII
INNER CURVE OF OCCLUSIAL CONTACT XIV

Fig. 4.

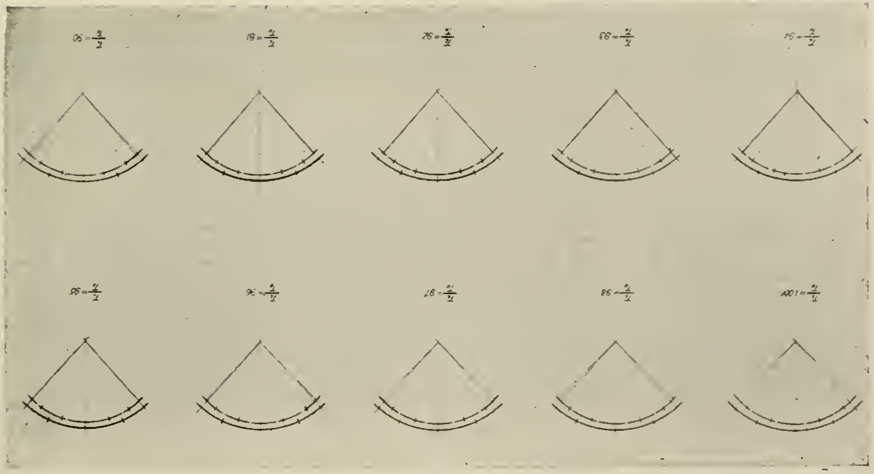


Fig. 5.

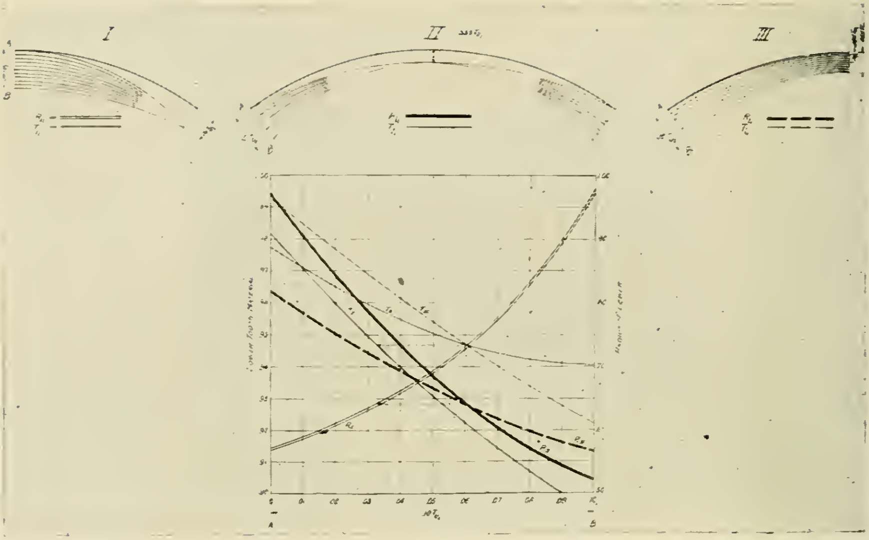

I
II
III
A
B
R_I
T_I
R_{II}
T_{II}
R_{III}
T_{III}

Fig. 6.

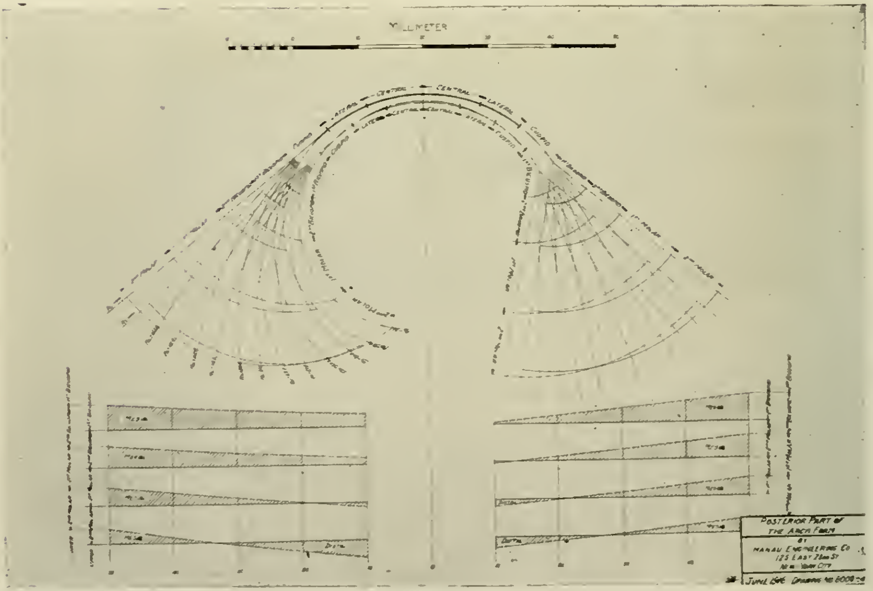

MILLIMETER
CENTRAL
LATERAL
CUSPID
POSTERIOR PART OF
THE ARCH FORM
BY
HANAU ENGINEERING CO
125 EAST 23RD ST
NEW YORK CITY
JUNE 1916 DRAWING NO 6009

Fig. 7.

scale which is photographed with the plaster cast. The photo-surveys may be made to any desired scale. Enlargements are urged for investigation and research work.

Measurements are made with the aid of dividers.

The use of the microscope has been advocated for making measurements directly on the plaster cast. For various reasons this method must be considered fallacious.

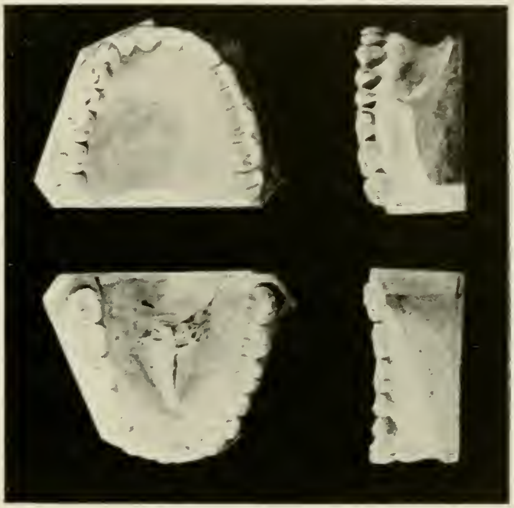


Fig. 8.

Excellent results are attained when the outlines of teeth, fossæ, cusps, etc., of both the upper and the lower denture are traced, brought into proper correlation, and printed on mat photographic paper.

On such a print, the teeth of the upper and of the lower jaw, appear in white on a dark background. Lines and points belonging to one jaw are differentiated from those of the other by various-colored pencil or ink lines.

In some of my work I used celluloid films instead of tracing cloth. A photographic contact print or enlargement was made directly upon the films. The lines and points of interest were marked on the film with India ink. Then the film was washed in a bath especially prepared for eliminating the photographic print, the India ink remaining upon the film. The result was a perfectly transparent survey, which could effectually be brought into proper relation with the mating jaw, or with surveys of the same jaw, in its various phases of treatment.

Arch Form. For a given set of teeth there exists not only one arch form which complies with our known rules of occlusion, but an indefinite number of them. The factors influencing the arch form, have already been presented to you on previous occasions.

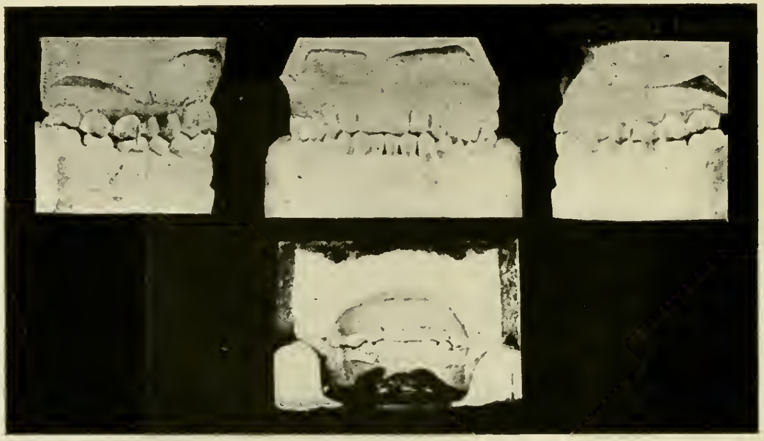


Fig. 9.

If only one form existed, it would be a matter of mere chance for any one man to predetermine it.

That means we should endeavor to reconstruct that arch form which most likely will conform to given conditions. This predetermined arch form is subject to changes because we are limited to a great extent in making accurate measurements. *If we were able to introduce absolutely correct measurements (which we can not do) and had absolute and full knowledge of all requirements that make occlusion and mastication perfect (which is not the case),* then we would be able to reconstruct an arch form best suited for a given set of teeth in the mouth. Whether such an arch form is the one Nature intended, can hardly be claimed.

At your last convention in Pittsburgh, I read a paper which pointed out the fallacy which considers the human arch forms to be similar geometrical figures such as the Bonwill or Hawley arch forms represent. With regret, I learned that it has not yet been possible to put my findings into print so that it may be accessible to the profession as a whole. Permit me to refresh your memory by showing a few illustrations which are an integral part of that paper, and are of particular interest in connection with this article.

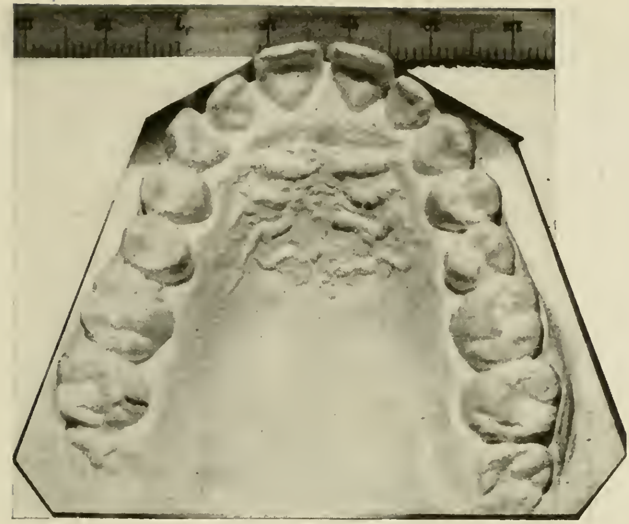


Fig. 10. Photo-survey of upper jaw. (A.)

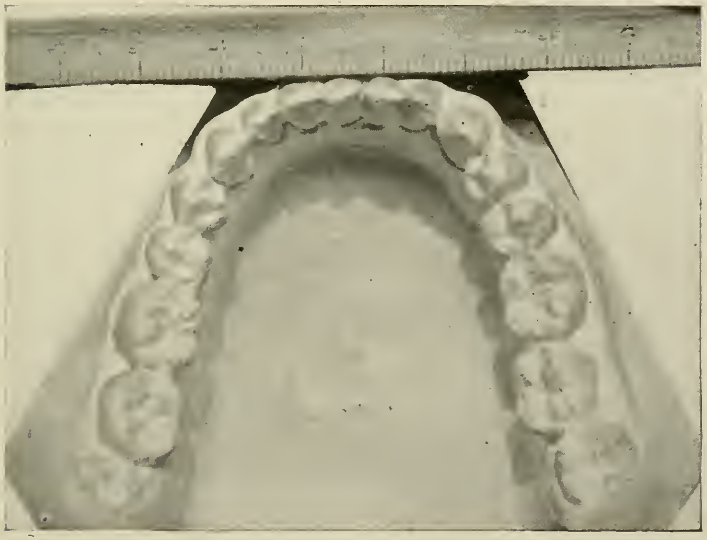


Fig. 11. Photo-survey of lower jaw. (B.)

It was pointed out that there exists a harmonious relation between dental curves (Fig. 4) where occlusion prevails. *This harmony immediately disappears on the survey of a denture in malocclusion.* Fig. 5 recalls the change of the radii of curvature for a change of the incisal

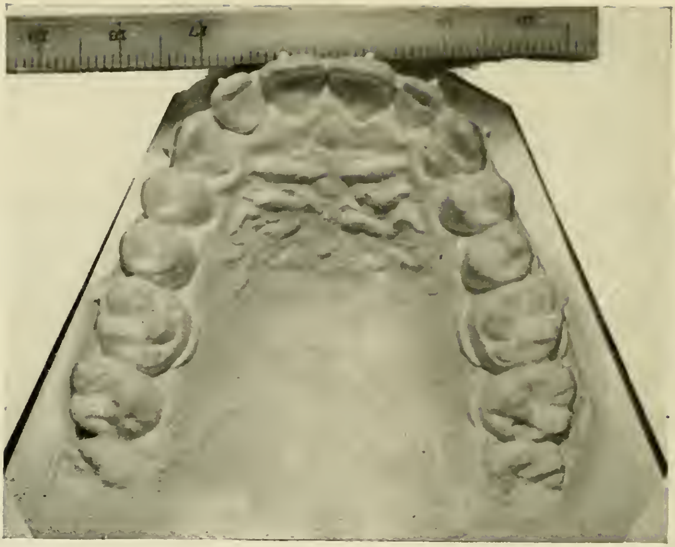


Fig. 12. Photo-survey of upper jaw. (C.)

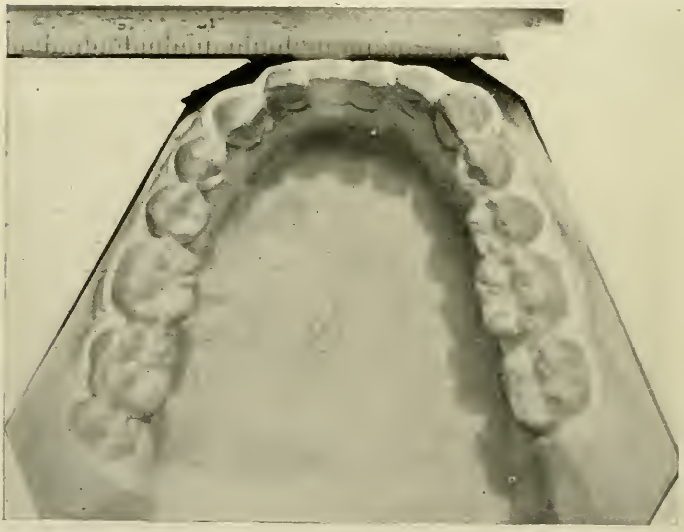


Fig. 13. Photo-survey of lower jaw. (D.)

ratio of the tooth material but constant labio-lingual distances of the C. C. Curves.

Fig. 6 illustrates the relationship of the lower tooth material and the labio-lingual distance to a given upper tooth material on a given U. C. C. Curve.

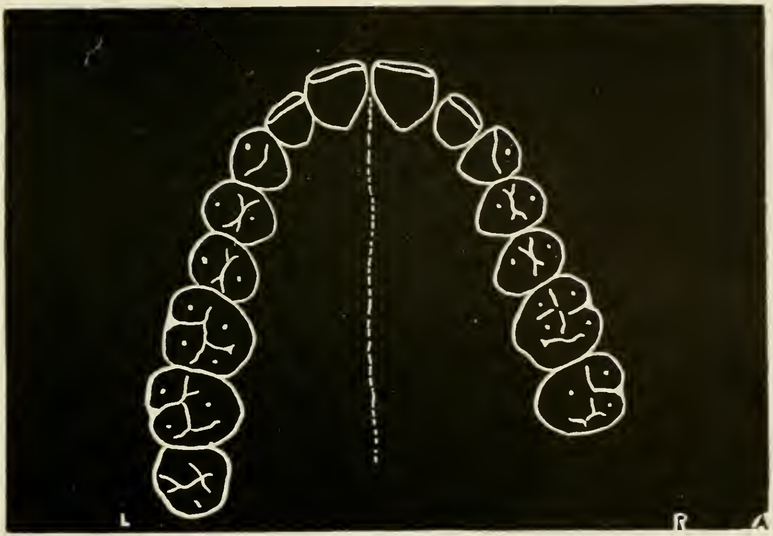


Fig. 14. Photo-survey of upper arch before treatment. (A.)

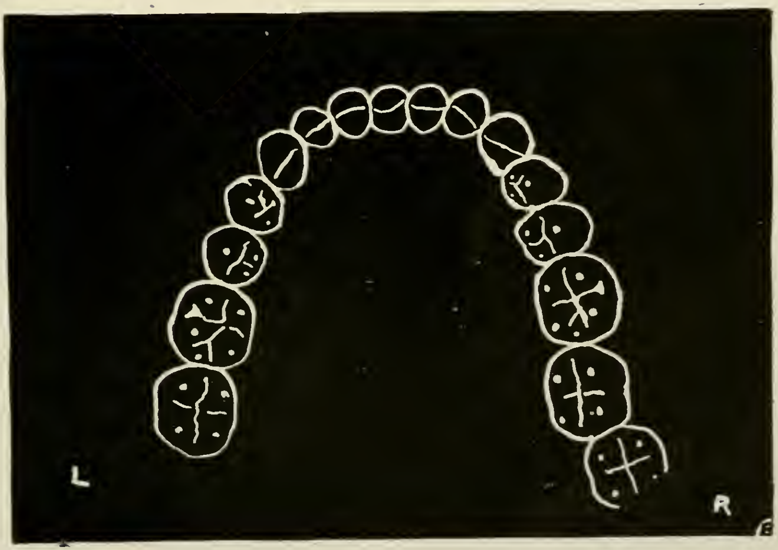


Fig. 15. Photo-survey of lower arch before treatment. (B.)

Those who have been searching for the solution of the problem of the overbite will find the answer in this figure.

Fig. 7 is a representation of the mesio-distal relation of points on the C. C. Curves for different radii of curvatures but for the same tooth

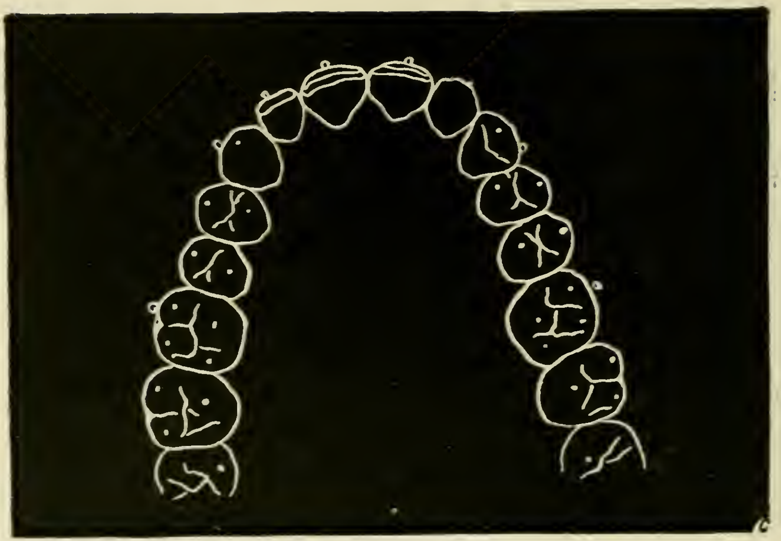


Fig. 16. Photo-survey of upper arch, supernumerary extracted. (C.)

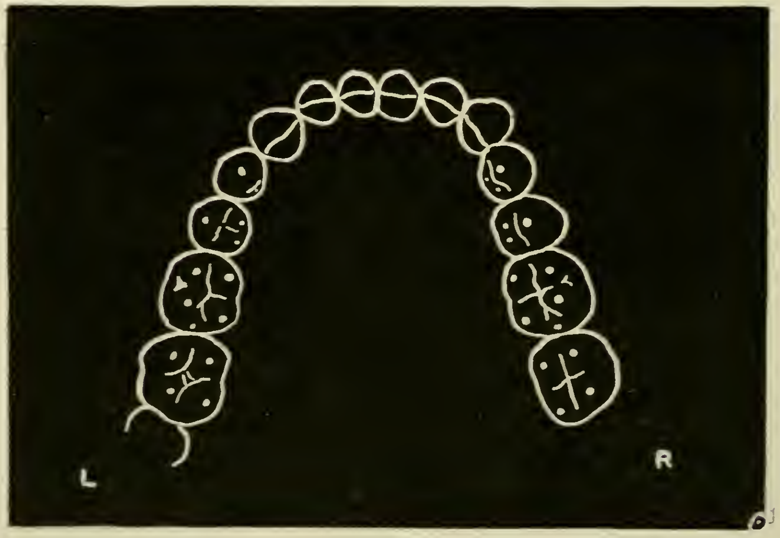


Fig. 17. Photo-survey of lower arch, supernumerary extracted. (D.)

material. At one time a sudden change in the cuspid region is considered and at another a gradual change of the C. C. Curves in their posterior extensions.

Fig. 8 is introduced to illustrate an ordinary photo-survey; cuspal

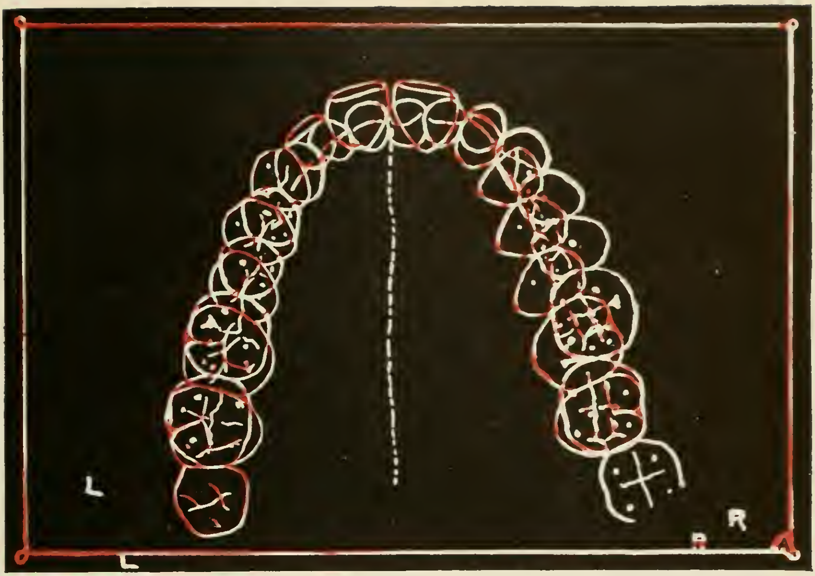


Fig. 18. A and B in their occlusal relation. Plan view of the teeth in their malocclusal relation. Case before treatment.

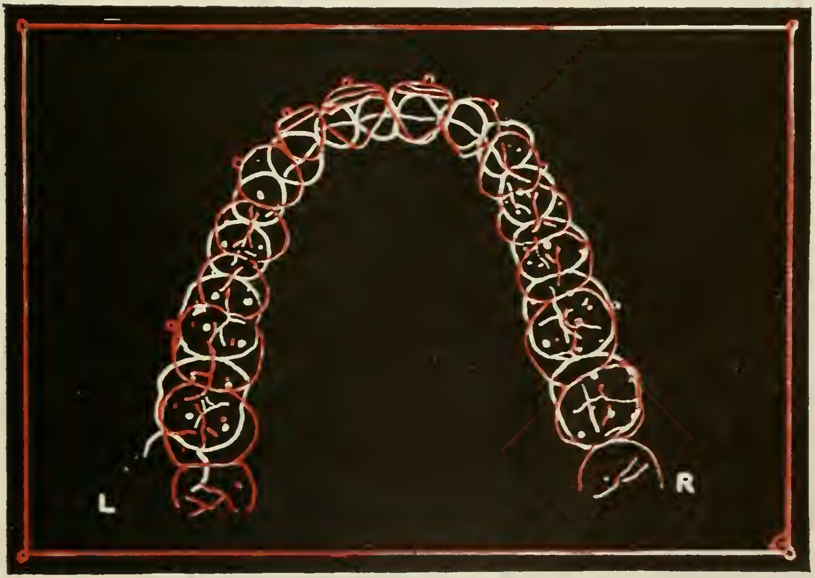


Fig. 19. C and D in occlusal relation. Plan view of the teeth in semi-occlusal relation. Case under treatment.

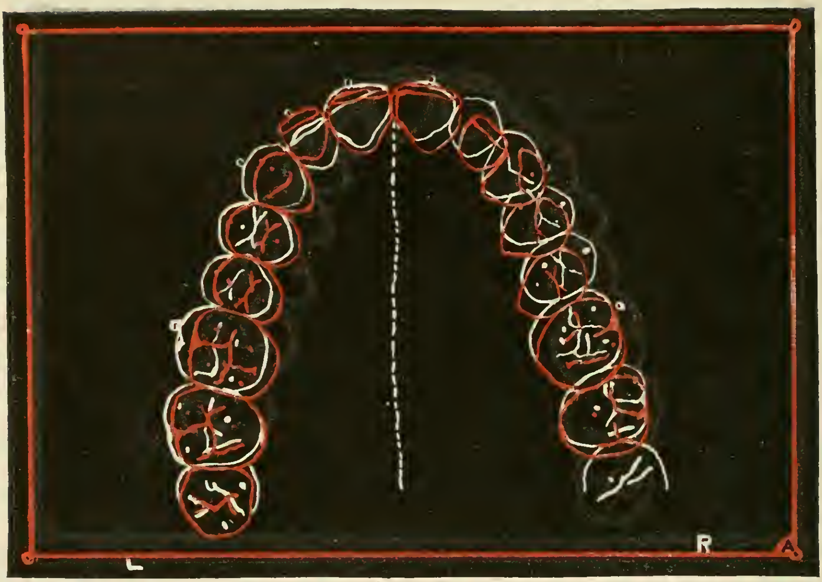


Fig. 20. Plan view of upper arches (A and C) brought into relation to show change of position of the upper teeth.

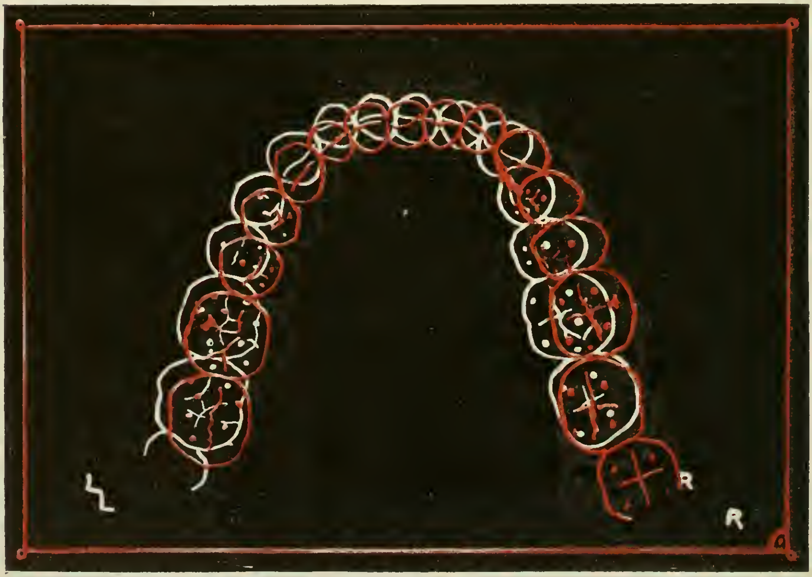


Fig. 21. Plan view of lower arches (B and D) brought into relation to show corresponding change in position of the lower teeth.

views of the upper and lower arch, as well as the left side elevations of both are shown. Attention is called to the more rapid rise of the compensating contact curve (C. C. C.) ; this is due to smaller radii of curvature of the upper C. C. C. in the side elevation.

It is exceedingly difficult, if not impossible with the naked eye, *to compare the radius of curvature of a concavity with that of a convexity. On a photo-survey, the magnitude can be measured.* It may be mentioned that the lower buccal cusp curve (L.B.C.C.) and the upper compensating contract curve (U.C.C.C.) in the molar and cuspid region are almost equidistant curves in space.

The upper buccal cusp curve (U.B.C.C.) rises at its posterior end to, and even above, the U. C. C. C. This is due to the increasing buccal inclination of the molar crowns posteriorly.

I particularly point to these characteristic forms. which already are familiar to you, because they can be measured and recorded on the photo-survey. The value of records need not be emphasized; they speak for themselves.

Fig. 9 is a photo-survey illustrating the labio-lingual, linguo-labial, and bucco-lingual views of the same denture shown in Fig. 8. It is a beautiful specimen of an end-to-end bite, the plaster cast of which Dr. J. Lowe Young was good enough to let me use for this occasion.

The next case (Figs. 10 to 21, inclusive) traces the work of a case under treatment. The legends under the illustrations are explanatory.

These figures are a reproduction of the actual surveys delivered to the orthodontist. They were mounted on cardboard; ordinarily they are combined in booklet form.

This case is interesting on account of the enormous tooth movements which were requisite. A supernumerary incisor (the most distal left lower incisor) was extracted. The consequence was a change in position of every tooth in the mouth.

The arches seem to have been swung bodily. According to Figs. 20 and 21, the upper left and both lower halves were moved to the left while only the upper right bicuspids show a pronounced movement to the right on the survey.

It is evident that the entire remaining denture was not moved by an appliance anchored on the two bicupids mentioned. It would be very much like having a horse try to pull the *Leviathan* up the Hudson River to her pier. Therefore, we must have another explanation.

The forces of malocclusion, acting muscular forces, etc., were balanced during the state of malocclusion (set malocclusion). Through the extraction of the supernumerary, the equilibrium was upset. Tooth movement set in, muscular and other forces performed their normal function in forcing the teeth towards a new position of equilibrium, possibly into occlusion, and the orthodontist followed his calling by clearing the way of obstructions and gently guiding the teeth. Thus he cooperated with Nature.

The survey, if of any value in this investigation, must be a means of analyzing the case. The following analyses are offered:

Individual teeth or small groups of teeth were pitched against the remaining denture, successively; a rather tedious job. In our case, however, it is not likely that such a course was followed (Figs. 20 and 21).

The photo-surveys, indicate that stress was applied to pull together the right and the left lower arches.

Five teeth on the left were probably pitched against nine on the opposite side. The right second molar acted as a quasi-pivot, even though it had not rigidly or pivotally been connected with the arch wire. The wire pressed lingually against the first molar, the bicupids and the cuspid.

The anterior and posterior resultant forces terminated, say, in the third molar and the cuspid.

So far as transmission of forces within the arch is concerned, the cuspid was resting on the four incisors; the latter progressed in line towards the open space left by the extracted tooth, the remaining left was necessarily pulled towards this very space, and was carried buccally. Strong intermaxillary forces acted in realigning the right first molars and bicuspids. The upper centrals, as appears on the survey, were righted by swinging their roots labially. Contrary to this hypothesis is the observation that both the upper and the lower left cuspid region were carried labially. I am inclined to believe that the relation of the teeth shown on the survey is somewhat exaggerated, the new position of the teeth being shown too far to the left. But, if the surveys are correct, strong forces, probably muscular forces, may account for such surprising movements.

It is of great importance to mention that all these tooth movements were reconstructed on the assumption that a molar can not be moved distally.

During the early stages of my work, it was impressed upon me that it is advisable to reconstruct the arch, on the assumption, of course, that it should be done with the least tooth movement. I have found, and hope to prove to you in the near future, that such a dogmatic rule is erroneous.

Either one of the analyses given, or a combination thereof, may be accepted as correct, *but that is not the issue. Through cooperation of the orthodontist and the dental engineer, the question could easily be settled.*

It was intended to show that photo-surveys are an aid to the orthodontist inasmuch as they represent valuable records which permit accurate research and offer a concise basis for discussion and interpretation of the orthodontist's aims and accomplishments.

Discussion of Mr. Hanau's Paper.

Dr. W. A. McCarter, Topeka, Kansas.

Mr. Hanau has been working out for us, along mechanical engineering lines, a system of dental arch measurements and his photographs in connection with his work are very valuable. What I have to say will be about the method of taking photographs which I have used in my office merely for making records. Dr. Lischer suggested to us a few years ago the importance of keeping good records of our cases, and further suggested that the photographic method would be a perfect way of enabling us to do that. At one time, Dr. Dewey in a lecture, showed front and side views of a patient in order to get an expression of the face, and a profile view. I conceived the idea of combining the two and making profile and front view pictures at the same sitting. The work has been done entirely in the office. As I have a small operating room, about ten feet by seven feet in dimensions, I try to condense everything, and I take the picture in two mirrors. Fig. 1 shows the interior of the office.

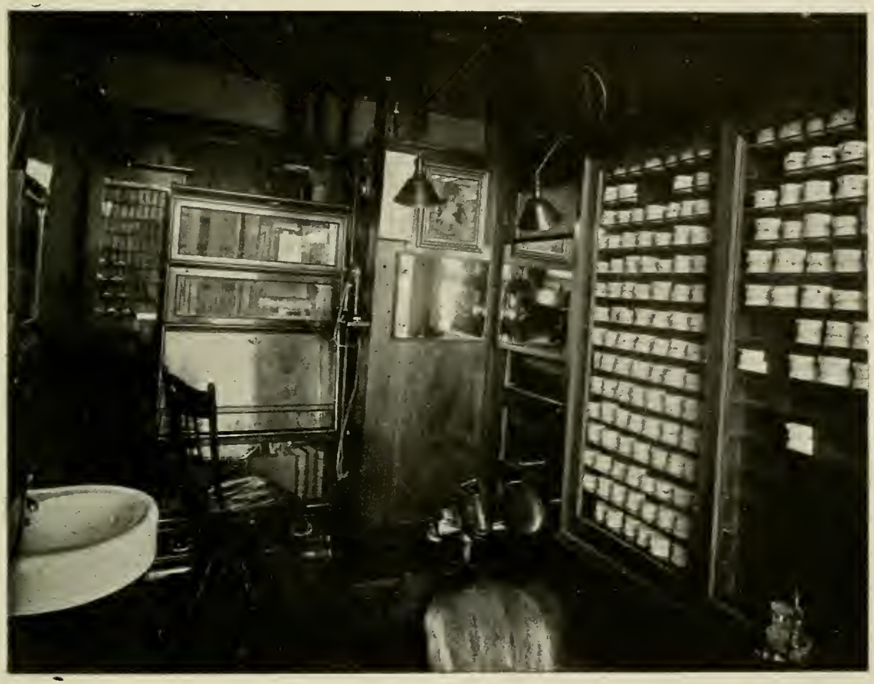


Fig. 1.

Instead of taking one side of the face, I arrange a double mirror to get both sides of the face at the same time. In the corner, where the door

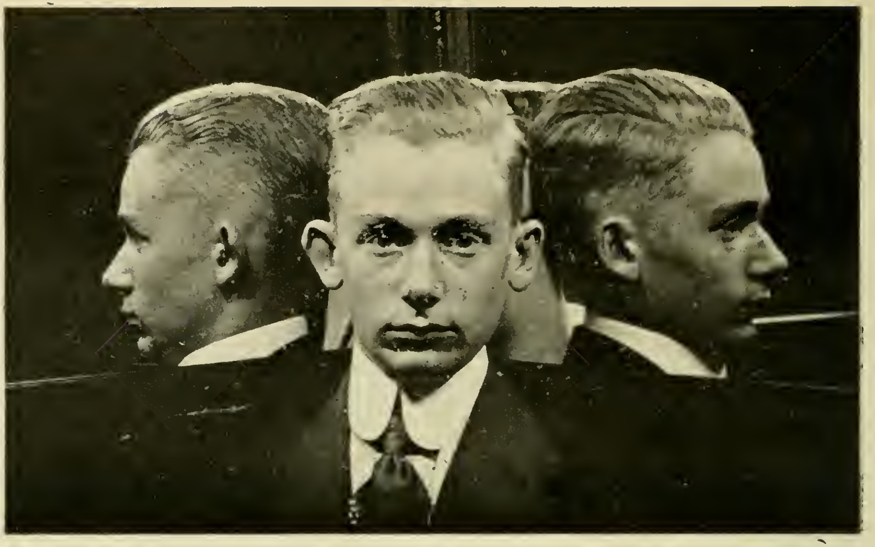


Fig. 2.

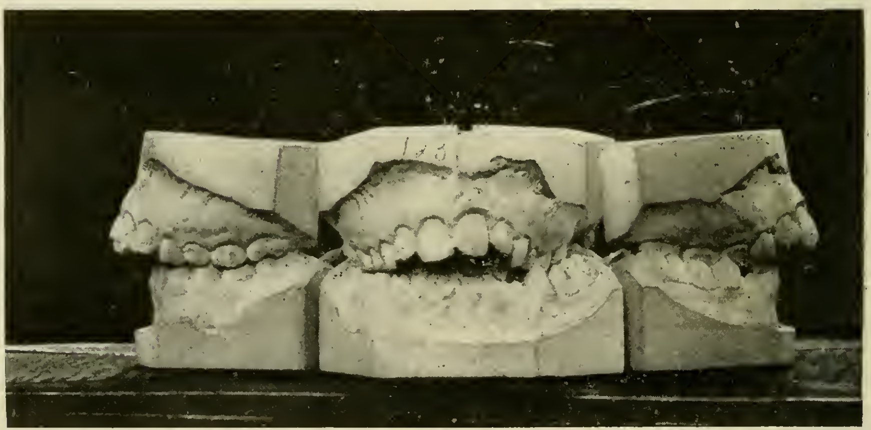


Fig. 3.

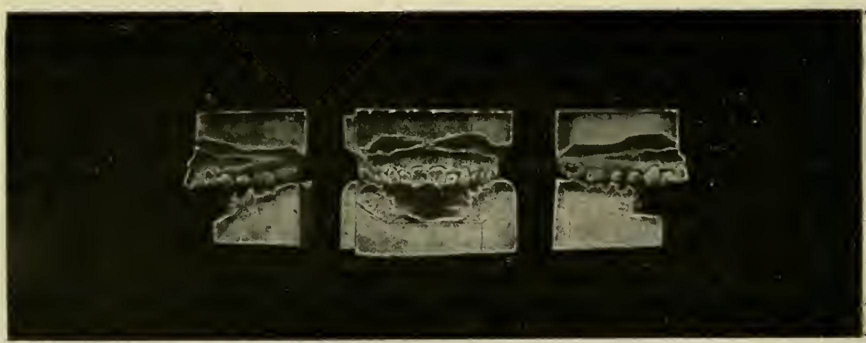


Fig. 4.

leads into the operating room, I have attached a mirror to the door, and another mirror at a right angle on the wall. Two shaded lights are placed to reflect the light on either side of the face. The subject is seated on a stool in the angle between the two mirrors, facing the camera which is set about six feet from the mirror. Thus a picture is secured of a direct front view and both sides of the face at the same time.

Fig. 2 shows a picture taken with a double mirror. Sometimes there is a little difference in the two profile views of the patient. I take them both in one picture merely as a record.

In the same manner with the same mirrors, a triple picture of the model is taken. By it is shown both right and left sides of the occluded casts as well as the front view (Fig. 3).

Mr. Hanau as shown us an illustration where he had a "multiview" picture. He took two separate pictures and put them together. By my method the same result is obtained with one exposure.

In taking pictures, Mr. Hanau has explained from a mechanical engineering standpoint that we must have angles in a certain position. One of the mirrors which I used is fastened to the wall and the other is fastened to the door. I can change the focus of the reflected image, by increasing or diminishing the angle. With an angle of 45 degrees the profile reflection in the mirror is distorted, making it smaller than the front view. By having one of the mirrors on a hinge you can bring them closer together and get pictures of the same size.

Fig. 4 is a picture I showed last year at Pittsburgh. You may remember it. It was taken with two small mirrors, and a light camera. I think it was one of the Eastman kodaks, about No. 3-A. It is one of those things that is handy and can be set up anywhere and a picture taken with it.

I have shown you my system of taking pictures. It is a very simple and inexpensive way of keeping records.

Mr. Hanau. The method which Dr. McCarter employs is excellent for large objects and probably the most convenient, but it is limited in its accuracy, unless special provision is made to compensate for the perspective. It must be kept in mind that the ordinary photograph is a perspective and that the side views are images; therefore, the right side view appears to be a left profile and vice versa. If it should ever be necessary to eliminate the latter defect, then I suggest that films instead of plates be used, and the film be reversed (that is, the side views only) when printed. As a relative record, I do not doubt that the pictures Dr. McCarter showed fully serve their purpose. I know that a photograph which ordinarily is a perspective is a rather inconvenient base from which to make absolute measurements and I have found it to be most unreliable and deceiving.

Dr. R. Waldron, Newark, N. J. In discussing this paper by Mr. Hanau, which I did not receive until today, I find it entirely different from its title and what I had expected it to be; therefore, I am not prepared to talk upon it as I would like to.

Mr. Hanau has shown us a photographic apparatus and has urged the importance of taking photographs of our cases for arch predetermination. Here I disagree with Mr. Hanau, for it is not necessary to have an engineer to compute all our cases, and when we do seek his services, he should make these orthographic projections of the models sent to him, for accuracy must be followed in every detail.

Mr. Hanau speaks of the superiority of the photographs as compared with the charts made with the surveying instrument. I purchased one of these surveying instruments and I am frank to say that I do not use it, for when I have a case which necessitates a survey I send my models to the engineer and let him use whatever method he pleases. All I am concerned in is his ideas of the solution of the problem, and then I am governed by my own judgment.

The question has been raised with reference to one type of arch. You know and I know that when we have a dental arch in malocclusion we can regulate the teeth to our satisfaction and to the satisfaction of the patient. Another man may take the same case and get a beautiful occlusion with a slightly different shaped arch by placing the teeth in a slightly different position.

As to the value of photographs of this work presented by Mr. Hanau, we have a great many doubting Thomases, but I am thoroughly convinced it has its place in the small minority of cases, for with the tooth material of one jaw harmonious in size with those of the other I believe these surveys are unnecessary.

Dr. Hawley had a case in which he found that he had an excessive amount of tooth material on the lower six anterior teeth. He extracted one of the lower laterals and obtained a beautiful occlusion. Later he sent his models to the dental engineer who suggested as one solution of the problem the extraction of that particular tooth which Dr. Hawley had removed,

As another solution of the problem he recommended an end-to-end bite of the anterior teeth, and this you know was impossible as the forces which govern occlusion would be seriously interfered with and therefore, we could not expect to preserve the integrity of the arch by so doing, for the normal over-bite has a great deal to do with the same and the normal approximal contact of the teeth would have been destroyed.

I have a case at the present time on which I have been working for two and a half years. The molars and bicuspids are in beautiful occlusion with sharp deep cusps but I can not place the six lower anterior teeth in the arch and get occlusion. After measuring these teeth and spending considerable time in the study of this case I came to the conclusion that there is an excessive amount of tooth material in the lower six anterior teeth. The best way I thought to deal with this problem was to rotate the lower cuspids, which I did, and after doing so, I slightly rotated the laterals and even then there was too much material, and I am sure that the only way in which to get good occlusion is by the removal of one of the lower teeth. I intend to send this case to Mr. Hanau and ask him which tooth he would extract to bring about the best results.

These cases are a very small percentage of those which we are called upon to regulate, and I think such cases should be sent to these men who style themselves dental engineers but I do think it is a waste of time and money to send all our cases to these gentlemen when we can get results that are both satisfactory to ourselves and our patients without their cooperation.

Dr. B. W. Weinberger, New York City. We are talking about extracting, where we have five incisors, a certain tooth, especially a lateral, to obtain occlusion. This model (indicating) shows as nice an occlusion as I have ever seen. You will notice, of the five lower incisors, outside of the central one, there is no overlapping, and that one only a trifle. There are no means we can use to obtain a better occlusion than we have there. If we extract a tooth, what is the result? I have two cases in my own practice with five lower incisors that have "normal" occlusion, probably one of those types of cases where the upper tooth substance has been taken care of by Nature enlarging it to compensate for the lowers.

Mr. R. Hanau. That is almost an end-to-end bite.

Dr. Weinberger. Nature has compensated for that by decreasing the labio-lingual distance at the median line.

Dr. Waldron. There is considerable depth to the bicuspids on this side.

Dr. Weinberger. Yes the molars as well, but those teeth are all in occlusion and in articulation, on both sides.

Dr. Waldron. There is considerable overlapping of the lower incisors.

Dr. Weinberger. Very true, but only the center one. I would not extract a tooth like that. This is the skull of an Indian who was forty or fifty years of age. As you can see there was a pyorrheal condition nevertheless, a majority of us wish we had as perfect an occlusion.

Dr. Ray Robinson, Los Angeles, Cal. It has been my experience that the teeth of one jaw do not harmonize with those of the other in size except in rare cases. I want to go further and say that the two lateral halves of the arches do not correspond in the measurement of the teeth. There is the greatest latitude there. I had one case where one central incisor was three millimeters wider than its mate. I can show you bicuspids from one to one and a half millimeters wider than the corresponding bicuspids on the other side. It is rather rare to find cases where the two lateral halves of the arch correspond in measurement. It is the great latitude which we have in the amount of over-bite that permits us to get anything like normal occlusion.

Dr. C. A. Hawley, Washington, D. C. This work of Mr. Hanau's impresses upon our minds the fundamental conception of the relations of the teeth which Dr. Robinson has spoken of. If any man starts out with the idea that the teeth in the upper and lower jaws, or even the lateral halves of the same jaw are in absolutely accurate relation, if he takes measurements he would have that idea taken out of his head. All the variations Dr. Robinson spoke of occur. Some twelve years ago, I measured a good many teeth to establish the arch. I took a large number of measurements of the mesiodistal widths of different dentures from molar to molar and laid them out on a straight line one after the other, upper and lower, supposing, of course, there would be uniform variation in the length of the lines of the lower and lines of the upper; but there was nothing of the kind. I did not go any further to work out the amount of variation.

I am impressed very greatly with the value of Mr. Hanau's work, and especially when he shows that there are several arches in which teeth can be practically placed. When Dr. Stanton told us as the result of his investigation, that there is only one arch in which the teeth could be placed in proper occlusion, I think every man with experience hesitated to accept it.

I wish this matter could be simplified, and it seems to me it can be. The range of that variation which would influence our treatment occurs, if I understand Mr. Hanau rightly, anterior to the first bicuspid tooth; that is, it occurs in the front teeth. If we take the sum of the sizes of the upper and also add the sizes of the lower and then divide the lower by the upper, we get certain ratios which, together with consideration of the labio-lingual distances, will enable us to establish occlusal relation. A change of either factor must change the shape of the anterior curve.

I want to correct the impression that Dr. Waldron gave you in regard to the particular case to which he alluded. I did not work on the case for a long time before I reached a conclusion. This young lady was twenty years of age and I could see at a glance there was something unusual. I arrived at a conclusion in this way: I measured the upper six front teeth and laid the measurements down with a pencil on a curve: I drew on a piece of paper a curve I thought the arch ought to take. It was the curve of a Bonwill arch. I laid on that curve just the widths of the six anterior teeth; then I took the distance from the incisal edge of an incisor down one-third the lingual slope where the edges of the lower ought to be. I drew a curve of the lower teeth at that point and measured off the lower teeth on that line. I could see at once we could not get these four incisors in that curve. But I made another one and put in three, and that went in exactly. I extracted the lower incisor and obtained my result. I talked over the case with Dr. Waldron, and the case went to Mr. Hanau and his surveys corroborated the result. I examined two models belonging to a friend of mine, an orthodontist, who was struggling over these cases. He had been treating them some time and could not get an over-bite. We went over them in the same way, and I decided that the only way to get a normal over-bite was to extract a lower incisor. He did not do it. He thought that these teeth were exactly proportionate but he never secured good occlusion. To treat my case and get an end-to-end over-bite would have been foolish. I can not do that sort of thing. I could not do it for this lady without producing a disproportion in her features which would not be permissable.

I had another case which Dr. Waldron spoke of in which the reverse condition occurred. This case had been treated a long time. I had too much tooth material in the upper jaw. Mr. Hanau surveyed and corroborated the condition. I wish there were five lower incisors in this case, but they are not there, so I started to move the six anterior teeth forward and leave a little space between the lower first bicuspids and cuspids. In that way I can get a normal over-bite and normal occlusion.

Mr. R. Hanau. Dr. Waldron very correctly stated that it is unnecessary to survey every case. It was not my intention to convey the idea that it would be necessary; however, I wish to urge you to study and understand surveys, not only as such, but as a means of investigation and planning. You may then foresee the changes in occlusal relation for certain changes in the arrangement of the tooth units or groups. For instance, you will be able to solve the problem of how to produce a more pointed or blunt arch form (change of the compensating contact curves) by changing the relation of the teeth in one or both jaws; also how to overcome defects in the occlusal relation about the cuspids or any other part of the denture.

I realize the course I suggest seems a difficult one, inasmuch as it involves descriptive geometry which is not included in the curriculum of dentistry or medicine, and is not particularly attractive to those who have not had occasion, to familiarize themselves with the subject. Nevertheless, I believe I may presume that upon studying descriptive geometry, you would soon know more about it than I do about orthodontia. I assure you, you need geometry more than I do orthodontia! Why? As orthodontists, what are you doing? Simply performing engineering work in small space; and, one of the main axioms of engineering is descriptive geometry.

I wish you would give this subject more serious consideration. I believe it will be to our mutual advantage. It would stimulate further investigation and no doubt lead to some very valuable results.

I greatly appreciate your attention and heartily thank you for the interest taken in this subject.

Report of Committee on Nomenclature.

The Committee on Nomenclature recommends the use of the following terms:

Neutroclusion to designate such malocclusions as are characterized by normal mesio-distal or normal antero-posterior relation of the lower arch to the upper arch.

Distoclusion designates such malocclusions as are characterized by a distal or posterior relation of the lower arch to the upper arch.

Mesioclusion to designate such malocclusions as are characterized by a mesial relation or anterior of the lower arch to the upper arch.

Malpositions of the teeth to be defined as the relation which the individual teeth bear to the line of occlusion, the median line of the face and the individual denture.

Mandibular teeth to be used in preference to lower or inferior teeth.

Maxillary teeth to be used in preference to upper or superior teeth.

Mesioversion—a tooth which occupies a position too near the median line of the face.

Distoversion—a tooth too far from the median line of the face.

Buccoversion—a tooth which occupies a position buccally to the line of occlusion.

Linguoversion—a tooth which occupies a position lingually to the line of occlusion.

Supraversion—a tooth which is too long as related to the plane of occlusion.

Infraversion—a tooth which is too short as related to the plane of occlusion.

Torsiversion—a tooth which is rotated on a perpendicular axis.

Transversion—a tooth which is in the proper vertical plane, but is in incorrect numerical order.

Perversion—an impacted tooth lying in an abnormal plane.

Deformity of the jaws to be used in reference to extreme malformations and maldevelopments.

Macromandibular deformity—a mandible which is too large.

Micromandibular deformity—a mandible which is too small.

Macromaxillary deformity—a maxillary which is too large.

Micromaxillary deformity—a maxillary which is too small.

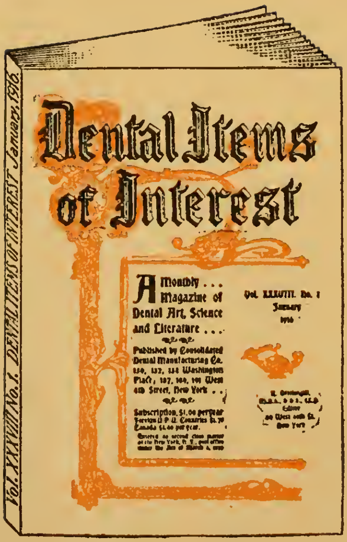
Orthodontia to be used for the practice.

Orthodontics to be used for the science.

Orthodontic to be used for the adjective.

Orthodontist one who practices orthodontia.

Presented in open meeting and adopted.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THE AMERICAN SOCIETY OF ORTHODONTISTS

Serial
1918

EIGHTEENTH ANNUAL MEETING
HELD AT
CHICAGO, ILLINOIS, AUG. 1, 2, 3
NINETEEN HUNDRED EIGHTEEN

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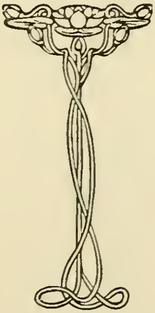

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Dates and Places of Meeting of The American Society of Orthodontists

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First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30 and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

Tenth Annual Meeting held at Denver, Colo., July 13, 14 and 15, 1910.

Eleventh Annual Meeting held at Boston, Mass., September 20, 21, 22, 23, 1911.

Twelfth Annual Meeting held at Chicago, Ill., July 1, 2 and 3, 1912.

Thirteenth Annual Meeting held at Chicago, Ill., June 30, July 1, 2, 1913.

Fourteenth Annual Meeting held at Toronto, Canada, July 2 and 3, 1914.

The regular 1915 meeting was abandoned in order not to interfere with the section on Orthodontia of the Panama Pacific Dental Congress, held in San Francisco, Cal., August and September, 1915.

Sixteenth Annual Meeting held at Pittsburgh, Pa., July 20, 21 and 22, 1916.

Seventeenth Annual Meeting held at Excelsior Springs, Mo., Sept. 5-8, 1917.

Eighteenth Annual Meeting held at Chicago, Illinois, Aug 1, 2 and 3, 1918.

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President's Address.

By D. Willard Flint, D.D.S., Pittsburgh, Pa.

"What we call trifles are the hinges on which swing open doors of destiny" was the subject of a discourse I heard in Ann Arbor some twenty-three years ago. It has been ringing in my ears ever since, so that it has made a deep and lasting impression upon my mind. It might have been a "trifle" that, to my lot was given the privilege of teaching a class of boys and in that class to have one with a very bad case of malocclusion. This boy was taken to four of the best men in our city, two of whom were doing all the orthodontia work they could get, and yet not one of them would undertake the case. It might have been a "trifle" that I borrowed a paper covered edition of Dr. Edward H. Angle's book and undertook the case, before ever entering a college, and I may add that I am proud of the result to this day. Again, it might have been a "trifle" that I should have been introduced to Dr. Angle while on his way to Paris to read a paper and to have him personally invite me to St. Louis to study orthodontia with a class; yet to me, as I see it, it was but the step by step of gradually leading me to my life's work, and for every step of the way I am profoundly grateful.

It is worth while in youth to get a vision of some kind of useful constructive work and I know of no body of men who are more fortunate than the men who have seen the possibilities which lie within our reach. Every day I see before me, in motto form, a truth from the pen of one of our members, Dr. Rodrigues Ottolengui, which I feel ought to be engraven on the minds of the whole profession, and I wish here to quote it as a creed and a classic:

> "I believe medicine, the art that heals, to be the highest and noblest calling to which man may devote his life. And of all branches of the healing art, what more attractive, more beautiful, more honorable than to take into our care the children of men, and by our labors to make them more perfect and more beautiful men and women?"

I prize highly my membership in this Society, for to me it has furnished the opportunity of visiting our large cities from one coast to the other, many of them for the first time. This alone would have been worth while, but more valuable than the visiting of the cities has been the opportunity of associating with kindred minds, and this morning I feel that we have a fraternity of feeling in this body, because of our years of association together. We are receiving many new men and we trust that they soon will feel that they are a real part of our great body, and that we each will be indispensable to the other's welfare. I want here to call attention to the fact that we must guard well our membership.

It was a source of grief to me at our meeting last year to find a goodly number of men that were recommended for membership and had actually been elected, who could not honestly have qualified; and mind you, it was not their fault. In this body the sponsor is the one who should be held responsible, as it is not possible for your Board of Censors to do otherwise than take the word of members already elected, as to the fitness of applicants. And while we are on this thought there must not be any letting down of the bars into our Society, for there are always those who seek to capitalize their membership in a society having standing and a history.

The War.

Another annual session has rolled around and I must confess that my mind has been much more interested in things pertaining to the war than in sitting down and writing things orthodontic, and until my printed program arrived I had not even given this address serious thought. However, we are in war, up to the hilt and from even this distance we must confess and agree with Sherman that "War is Hell!" and what shall we say concerning it all?

I have postponed writing in the fond hope that by this time we might have seen the enemy crumbling, but it might be that a wise Providence has not yet seen that the time is ripe for a righteous victory. However, we see clouds arising even if they are but "the size of a man's hand" and victory is just behind the clouds.

Yes, I know there is a war during the week days and also on the Sabbath, for I am forceably reminded that of the eighteen young men

I had under my care, just one is left. All are in the Service, and I would not have it otherwise, for they have caught the vision of an outraged world, and with real blood in their veins they have in their own way gone forth, to do their own work. Yes, and we who are at home have a real work to do.

May I ask, "Are we losing or gaining in our loyalty and ability to render unselfish service?" Not many years ago we used to hear, on all sides, "the world owes me a living," but things have changed, it is not so much now "Who is who" as "What is what." We must say, "We owe the world everything we have. Our time, our labor, our money," and that we will give ourselves unreservedly in service for the welfare of mankind.

At the battle of Austerlitz the soldiers wore on the lapels of their coats this motto "I was there." It will be "God help the fellow" who, after this war is over, cannot point with pride to the fact that he did his best in whatever way he was permitted to lend his energies.

Membership.

Our membership is worth while; then let us not cheapen it, but rather make it more worth while. Since a copy of our proposed new Constitution and By-Laws were mailed, I have had numerous letters of protest against throwing open our membership, and I think I do no wrong when I call your attention to the same. I am here reminded of the difference between the goods that are kept in glass cases in our best stores and the kind that everybody picks up, handles, throws down in our cheap stores. Those of the general profession have always been made more than welcome in our meetings, and have been shown courtesy, but they are not thinking intensely along our special line and would have very little to offer. So I trust that wisdom will be shown when we come to deal with such an important matter, when the question of changing the Constitution and By-Laws comes before you. I am proud of my membership in this Society for another reason, and that is, that in the sixteen years I have been a member and attendant, I have never been asked to vote for anyone, or anything. The Society is clean and absolutely free from politics and I trust the day will never come when we will have to stoop to anything that even looks "little." I believe the informal ballot has been responsible for much that has been good in the past, and if I read the proposed By-Laws aright there is a proposition to change this.

Effect of Bands on Teeth.

Since Dr. Fred Kemple raised the question in Pittsburgh two years ago concerning the effect of continually keeping bands on the teeth, and the possible injury that may come from a histological standpoint, and not just from the physical, the thought came to me that I would make inquiry from the general practitioner who from time to time takes off gold crowns which have been on for a considerable length of time, and then simply fills the same. The record I get from these doctors is very favorable to absolutely no change in the structure, and that the fillings so placed have been lasting indefinitely. Personally, I think the bands that we have made have not been perfectly fitted and festooned under the free margin of the gums; or again, as the tooth has erupted more fully the bands do not perfectly cover the teeth or that the cement has washed out and thus we have incipient decay from that cause rather than from any internal weakness. This is a question that is before us every day. For every patient asks what effect the bands have on tooth enamel. I suppose I do not differ a great deal from each of you in that I tell them the ordinary process of decay comes from moisture, food and body temperature, and that when teeth are perfectly covered and the moisture is excluded by cement they cannot have trouble, except through willful neglect on either the operator's part or gross negligence on the part of the patient in not keeping the mouth clean? It satisfies them, but for my part I am not altogether so sure. There are some mouths wherein it would be a crime to leave a silk ligature on, the way we tie one for rotation, for even one week. And then again, we can do anything, even carelessly, and not a particle of harm come from it. While we are on this subject I would like to ask a fair question: "When a patient presents with every indication that the patients eats "jam on bread" before retiring for the night, do you undertake treatment in such a case or do you sidestep it altogether?"

Extraction.

If we read our journals closely I think we will not fail to observe that because of neglect and imperfect dentistry, with focal infections as a result, there is a wave of extraction going over the country that is appalling. The physicians will be more and more the abettors following the recent meeting of the American Medical Society meeting here in this city a few months ago. The question that has arisen in my mind is: "What shall be the attitude of our Society when we know the disastrous results that follow indiscriminate extraction?" If teeth have to be lost, what is our best manner of procedure to hold the given space in order that occlusion might not be utterly destroyed? We surely need some sign posts.

Democratizing Orthodontia.

Can orthodontia ever be democratized? One of the saddest things we have to contend with is the great number of cases that come to us and which we deliberately send away because we are too busy and simply cannot take on more than our physical power and time will permit. Naturally, we like to fish near the stream with the best fish. I would like to ask in the light of the fact that our schools are not equipping men properly, if the graduate dentist as an assistant would in any way solve the problem? Does the Society know of any orthodontist who is thus trying to meet the needs of the people in just ordinary circumstances? If our work is good and necessary for one it surely ought to be for all. "He merits most who serves best" is a slogan which has but a veiled truth. If this were the case many men of wealth would have filled the bill, but their names are a by-word, because all their endeavors have been for self. This war is teaching us many lessons in doing for the other fellow. To date most of us I think would have to plead guilty in catering to the wealthy rather than to those who have an aristocracy of the mind, but are a trifle shy on the pocketbook.

Radiography. In looking over the program I am pleased to see that we are to have something on radiography from a very capable man. It was my intention to state what a pleasure it has been for me to have a machine installed in my office and I am going to point the finger at everyone and say that it surely is a necessity, and I can prove it. You will claim you can send out for all that you want, but I do not believe there is a solitary man practicing orthodontia who has used the rays as much as he ought, when he did not have a machine in his own office. I just want to cite one case where I failed under such circumstances through no fault of my own.

The patient was a lad and there was no reason to suspect that any of his permanent teeth would be missing; and, as in hundreds of cases, I never even thought of using the X-ray. The jaws were expanded and retention placed. At the age of twelve, the boy returned to our city, having in the meantime moved three hundred miles away, and no orthodontist within a hundred miles. I found that a week prior to returning he had lost his second lower deciduous molars. Having a "new toy," I proceeded to look him over and to my chagrin I found no bicuspids following. Here is the situation: The boy is condemned either to wear a bridge all his days or until he later loses his abutments and then more trouble, which, in our present light, is not good practice, or he must have his molars brought forward. The case could have been finished had I known the truth at the proper time. I want to go on record and state that I believe if we are so ideal as we are "dubbed" by our friends, we cannot possibly render the best service without first knowing whether all the permanent teeth are on the way, and there is only one way of finding out, and that is by means of the X-ray. Therefore, it is up to us to *know* by getting a picture of the whole mouth before we can make even a good diagnosis to say nothing of the prognosis.

Conclusions. After sixteen years of real experience I have arrived at some very definite conclusions.

In the first place, I would never say just how long or short a time a case may require in treatment. Your guess may be as good as a 20 to 1 shot. Personally, I have lost one of my earliest attainments.

I believe that because one operator gets results with one kind of an appliance it does not follow you can do so with the same appliance.

That the metal materials we use in our appliances are of a very great importance and that we cannot use just any old thing and get results, and that "substitutes" are very often inferior and give absolutely bad results.

That it is wise not to overpromise. One's enthusiasm may get him into trouble.

That it is just as wise to drop an incorrigible patient as it is to cut off, in the business world, a "dead beat."

That the closer I observe the diameters of teeth the more I am convinced that the teeth are not nearly so symmetrical and harmonious as I once thought them to be.

That in a busy practice one does not always go into the etiology of every case, but that Mr. Etiology is just naturally forced on us when we get up against the real thing.

That the points picked up in our annual meetings (the real clearing house) are the real helps to carry us over the top for the oncoming year.

That our most appreciative patients are not the very rich.

That it is not good to take life too seriously, not even orthodontia, and that if patients will not conform their wills to yours it were better for both if relationship should cease.

That one ought to run his office and not let his office run him. I must add that this is an annual resolve with me, but being a Methodist I prove a good backslider.

That you cannot please all your patients, although I know of no calling where such a wonderful percentage will go the limit in singing your praises.

That arches that are "seemingly" retained the least actually have occlusion established the best.

That it is not necessary to cut and cauterize nearly so many "so-called" frenums as we were wont to do fifteen years ago.

That expansion of arches many times will free the postnasal space of growths without any operation.

That the annual visit to our meetings is just as necessary to our orthodontic growth as eating our daily meals is to our physical growth.

That the X-ray is not a luxury, but a necessity in the practice of every orthodontist.

That if you really want to work for a patient take time to fully explain the possibilities of the operation, and that this is really worth while for the impression it makes.

That a photograph taken before may save you from some charge that you have done this or that to some fastidious mother's daughter.

That with most people it is good business to write a confirmatory letter to your verbal conversation as to what you propose to do and what is expected on their part. Parents sometimes die.

That when writing letters to other men referring patients you would better not state anything you would not wish the patients to see. If you must send any private information, better enclose same on a separate sheet. Embarrassment may be thus saved.

That some cases are handled easily by some operators which prove troublesome to others.

That you cannot work for everyone who presents, and should be grateful when many go elsewhere.

That we get into ruts, especially in the line of treatment in our cases, and, without really thinking, we are going through the same procedure when, if we would but stop and think, another line would be much more preferable.

That we only learn by our failures, and that we have enough obstacles to keep the cobwebs from forming in any great numbers.

That children will soon discover if they have a "crab" or a friend, as an operator. Better be kind.

That there is real truth in the saying that a man should have a hobby, and, personally, I am sorry I did not take up the king of outdoor sports sooner. In one respect I differ from a man who wanted to get into the army over in England, and the physicians all said he was suffering from an incurable disease and could not be helped. He said he was born too soon.

That you have to get a "real bug" if you are to amount to anything.

That it pays from every angle to have a well-equipped office.

That we ought to get lots of fun out of our work.

That it pays to have a good assistant.

That all work and no pay makes for cranks, and that an orthodontist must keep young, by keeping sweet.

That we do not use psychology nearly as much as we should.

That what we know to-day may be obsolete to-morrow; and that the man who is not a student is scheduled for the skids.

That at times we have so much efficiency that it interferes with real work.

That it requires skill and experience to know how to handle mutilated cases.

That different operators have different conceptions as to what constitutes a normal arch form.

That it is worth while to have an open receptive mind to truth as it comes from different sources.

That good work is cheap at any price and that poor work is dear even if it costs nothing.

I wish personally and publicly to thank the Chairman of the Board of Censors, Dr. Ralph Waldron, for his effort of this year. Had I not had explicit confidence in him, I certainly would have been worse than the proverbial hot cake on a griddle, for I did not know what he had on his program until last month. Also at this session I should like to have the Society send greetings to Dr. Guy Hume, the one who would have been the Chairman of the Board of Censors had he not enlisted with the Canadians at the beginning of the war. Dr. Hume has not even had a furlough, and I have no doubt but that when he returns he will be able to bring back a very rich experience which will be helpful to us all.

Recommendations.

I would, furthermore, like to entertain a motion, at the proper time, that those of our number who have enlisted in the Service should have their dues remitted.

I would, furthermore, pass a compliment on to the great National body on their stand in that they have at last given orthodontia some recognition by creating a section for our specialty in conjunction with the periodontists. I trust that this Society will lend an ever-willing hand, and that the *National Journal* will have representative articles on our specialty.

I would, furthermore, like to recommend that in conformity with the National and many State Societies that the first Vice-President be installed the President-Elect.

And now lest you might think I am a base ingrate I could not close without thanking you for this great honor you have conferred upon me in permitting me to preside over this body of as intelligent men in their own line as assemble in any convention.

Someone has said people do not care what you say, just so you make it short, and this reminds me of the story they tell on a Frenchman who was at a banquet in New York. The evening had worn on until a late hour and just after an Englishman had taken his seat this Frenchman was called upon. He began thus: "I do not wish to further cockroach on your time as the hour is late." The audience started to titter, then to laugh out, so much so that he could not proceed, so he turned to his English friend and said: "Did I say anything wrong?" The Englishman replied, "You certainly did. You said 'cock-roach' when you should have said 'hen-roach.' " Oh, said the Frenchman, that is only a mistake in gender." So I shall not further encroach on your time, as I years ago learned to multiply the number of members present by the number of "hot-air" minutes that were consumed, and the lesson has never just quite gotten away. I would prefer much to be like our good friend Lourie; when he does open his mouth he says something worth while, and it is always *brief.*

I will close with just two quotations. The first, "It is only while we are green that we grow, and when we think we are ripe, we have begun to get rotten." And the second, "Couldn't thou in vision see thyself the man God meant, thou never more would'st be the man thou are, content."

Discussion on the President's Address.

Dr. Fred. C. Kemple, New York City.

Mr. President and Members of the American Society of Orthodontists and Guests: I want to compliment Dr. Flint on the excellence of his address. After reading his paper he suggested cutting out parts of it. The Board of Censors will see that his paper is published in accordance with the rules of the Society. I am sorry for Dr. Flint (laughter), but I am sure it will afford a great deal of information to the profession at large when they receive his paper just as he has read it.

Dr. Flint said some very true and very important things, and made, I think, some excellent recommendations. One of them was in regard to the proposed changes in the Constitution and By-Laws.

Restriction of Membership.

I happened to be a member of the original committee that drafted the first Constitution and By-Laws for this Society, and I believe it has been the purpose of the Society, almost from its inception, to be as broad and liberal minded as possible, with due regard for conserving the time of the members who travel great distances to attend these meetings. I mean by that, the bars of the society have not been completely thrown down to admit members of the dental profession in general, but on every one of our programs there is a cordial invitation extended to all members of the dental profession who are interested in orthodontia to attend these meetings. The privilege of the floor is extended to them; in fact, they have all the privileges of members of the society, and the society is glad to extend these privileges, except that of voting and discussing business matters, and I do not believe it would be wise to alter that provision of our Constitution, but, of course, that question will be further discussed when the proposed amendments are brought before the Society.

Co-operation of Orthodontists with Dentists.

I do believe that it is the duty of every orthodontist and of every society of orthodontists to aid every general practitioner and every other orthodontist in every possible way that will benefit him or benefit his patients. What I mean by that is that it is the duty of every orthodontist to aid any dentist who is inclined to do orthodontia for his patients. It is our duty to help him do it in the best way possible, because the sooner we realize that the specialists in orthodontia in this country cannot possibly take care of all the cases that require treatment, the better it will be for us and the better it will be for the profession at large and for the patients themselves. I think it the duty of every professional man to look out for the welfare of the patients, not only his own patients, but the patients of other practitioners. If he can do anything to aid another man, I do not care whether he is a particular friend, or whether he is not, he ought to help that man to do better work for his patients if he can possibly do it. I believe that is the true professional spirit. The other man may be your enemy or rival in your own town, but if you are a true professional man, you should help him to do better work for his patients if he can possibly do it. That is what this Society is aiming to do by inviting the dental profession to attend the meetings.

Proposed Changes in the Constitution.

Dr. Flint referred to the proposed amendments to the Constitution and By-Laws, and I want to say, in passing, that when I was Secretary of the Society I suggested a change in the method of making nominations for the officers of the Society. The original method was to make the nominations by mail ballot, and it was changed to make the nominations from the floor. I have altered my opinion about that. I believe it is to the interest of the Society and to the interest of every member of the Society to have nominations by mail ballot, because it saves a lot of time. It gives members who make the nominations an opportunity to consider those whom they believe are best qualified for the office, and they can make their nominations deliberately. If the nominations are made from the floor, as they have been in the past two previous meetings, they come at the last meeting of the session, when everybody is tired, when everybody is in a hurry to get home, and someone, seeing a friend sitting across the hall, jumps up and nominates him for office. I believe it is a question of conserving time. I do not believe there has ever been in this Society what is generally termed politics. I believe the President made the statement that he had never been asked to vote for anyone for any office in this Society. I have never known any person to ask anybody else to vote for any person for an office in this Society. In fact, we have been perfectly clear of so-called politics. Nobody has wanted office that I know of. I think it would be wise for us to return to the original method of making nominations by mail ballot.

Effect of Bands on Teeth.

Dr. Flint referred to my paper which was read in Pittsburgh and spoke about the possible effect bands might have on teeth. At that time I believe several members misunderstood what I meant to convey. I meant this: there has never been any investigation of the possible *structural* changes that may take place throughout the body of the tooth, initiated by this tooth having bands on it for a prolonged period. I did not mean possible caries; I did not mean the decalcification of enamel, but I meant that it would be a good idea for some of our members who are inclined towards research work to place bands on some of the teeth of young animals, leave these bands on for a given period, and examine histologically the structure of these teeth and compare it histologically with the structure of the corresponding teeth in the same mouth that did not have bands. I think it is perfectly possible there might be some structural change in these teeth due to wearing of bands for a prolonged period.

Ideal Occlusion.

The President referred to replacing missing teeth by bridgework, and so on. One should have thirty-two teeth in the mouth and there should be ideal occlusion. This is axiomatic. Any man who has been practicing orthodontia very many years has discarded the idea of always obtaining ideal occlusion, because, as the President has said in his address, he has come to realize that there is not always the symmetry and harmony in structures and tooth material in the human denture that he had previously been led to believe. You cannot obtain ideal occlusion and keep it in any mouth where the tooth material in the upper and lower arches does not harmonize with the arrangement of the cusps of the teeth; and when it comes to the question of replacing missing teeth, I would infinitely prefer a patient or a child of mine should have a tooth missing and have that space completely or partly closed than to start a young child into life with an artificial substitute of any kind, whether it is a tooth on a plate, or whether it is a bridged tooth. When we cling to an idea we very often lose the sense of relative proportion; we lose the common sense view. I think it is very important to give each individual child as nearly perfect occlusion as you can, with due regard to other matters. Life is not completely made up of teeth, and usually the artificial substitutes are a source of more or less trouble almost from the very beginning.

I wish to refer, also, to his remarks about cauterizing frenums. I used to cauterize a great many frenums. I do not suppose I have cauterized a frenum in the last five or six years. In many of the frenums, which I have cauterized, I believe the space between the central incisors was more difficult to close, because of the scar tissue, than it would possibly have been if the frenum had not been cauterized. I have seen many cases where these spaces have beautifully closed of themselves without any particular effort on the part of the orthodontist to bring the teeth together. If there was a frenum it was resorbed, and I believe in almost every case that ligamentous tissue will resorb if the teeth are brought together and held a proper length of time.

I do not believe I can add anything more to the discussion of this address. I want to thank the essayist for the many wise things as well as the witty things he injected into it.

Dr. R. Ottolengui,
New York City.

Mr. President and Gentlemen: Just at the close of the reading of the President's address, a gentleman behind me said, "That is the best President's address I have ever heard delivered before this Society." I think he forgot that I wrote one of them myself. (Laughter.) But, speaking for myself and not for the other Presidents who have written addresses, I indorse the gentleman's opinion. The most attractive part of the paper, I think, is to be found in the epigrammatic statements that were made and which the essayist said were put forward tentatively. I agree with Dr. Kemple that we cannot afford to lose anything of what Dr. Flint has said.

He said that the best thought in his paper was where he expressed the belief that we do not use enough psychology. I think that is a good thought, Mr. President. To me the pearl of the entire address is in the following language, because on it lies the important philosophy of our art, namely, "arches that are seemingly retained the least, actually have occlusion established the best." We might pause for a moment to let that sink in.

I differ with the President where he advises us to write to the attending dentist on a separate piece of paper. My recommendation is to telephone him. (Laughter.)

Excision of Frenums. I would like to say a word about the excision of frenums. Of course, only being partially engaged in the practice of orthodontia, I do not see as many cases as the exclusive specialist, but at the same time I have been practicing a great many years longer than some of those present, yet I have never cut out a frenum, nor have I ever treated a case of the kind where I regretted afterwards that it had not been cut out. Dr. Kemple said it will probably be more difficult to close the space after cutting out the frenum and allowing the cicatricial tissue to supervene. But I do not think, Dr. Kemple, that would be the best method of procedure if one really plans to cut out the frenum. A middle ground is a better course to take in treating the case without excision of the frenum. Bring the parts together either by compression or by actual resorption. If you have resorption and the parts can be held together long enough, you will not need a surgical operation. If you have only compression, and there is persistent ligamentous tissue present, you may test the matter by removing the appliance and observing the rapidity with which the parts separate. If you are then satisfied that excision is the right course to pursue, it should be done in my opinion at that time, and your original regulating appliance replaced immediately afterwards, the teeth forcibly brought together and healing allowed to take place.

Bands on Teeth. I want to say a word now about another important matter and that is about bands and crowns. The President says he has made a slight investigation of the matter by asking dentists who remove crowns from teeth, to report on the condition in which they find such teeth. I would like to call attention to the fact, Mr. President, that that is a totally different condition, because a crown has a top to it, whereas a band is open at both end, both at the occlusal end and at the gingival border, which makes a great difference. Where cement has completely covered the opening and the band goes under the gum, the tooth can be protected from caries. The point made by Dr. Kemple is an important one: where he speaks of placing bands on some of the teeth of young animals and after leaving them on for a given period to examine histologically the structure of these teeth and compare with the structure of the corresponding teeth in the same mouth that did not have bands. I do not think, Dr. Kemple, you need to go to the lower animal, because we can duplicate in a sense the work we did in co-operation with Dr. Grieves. We could band temporary molars and keep these bands on, and at the time of their shedding, these teeth could be removed with the bands and sent for examination to the man who undertakes the histological work for us, and it would be especially interesting if we had bands on temporary molars in one part of the mouth and not another, and would send a complete set of teeth to see whether there is any difference.

In conclusion, I wish it were possible that some parts of this paper might be published in gold ink. (Applause.)

Dr. George F. Burke, Detroit, Michigan. I would like to add a word or two in connection with the treatment of the frenum. It seems to me, there is a great deal of difference of opinion in regard to the wisdom of operating on it. Some practitioners do not believe in it, and it would be a valuable help to many men in orthodontia if they could better understand that subject. I would, therefore, suggest that the Board of Censors take up the matter of having a paper at the next annual meeting dealing with the frenum.

Dr. D. Willard Flint, (closing the discussion) To help the general practitioner appeals to me as a very good slogan. Many of us have been doing it, but as a solution to part of our trouble we all ought to go out of the way to do this very charitable thing.

Democratizing Dentistry.

By Allen Holman Suggett, San Francisco, Cal.

When England called her first three million men to war, one million of them were rejected on account of their teeth. One million out of three: one-third. This meant that one-third of the English people were unfit—on account of their teeth. At any rate that is the way England saw it.

England then awakened to a realization of the importance of dentistry.

England had to wake up and Italy must: and France: all Europe, and the civilized world; including the United States, including the dentists of the United States; including even the American orthodontists.

The American dentist is the leading dentist in the world. Even efficient, self-sufficient Germany had, and still has an American dentist for the Kaiser; for the Kaiser, the Junkers and the war lords. In all the great capitals, Americans are the dentists of the rich, the aristocratic, and also the scientifically informed. There is no doubt at all about our social and professional standing. We have made ourselves and our country the world leaders in the science, the art, and in the business of dentistry. And the leading American dentist is the orthodontist.

But this boast is uttered here in this presence, not to boost our pride (and our prices), but to recall very humbly to mind the reason for our high eminence, and to add to our burden the full weight of the leader's responsibility.

The American orthodontist is the leading dentist in the world, because he happens to be practicing and pioneering toward preventive dentistry: not because he is a great and good man, you understand, but because, almost by accident, he finds himself working in the direction in which the world seems to be moving. No matter: his obligation as a leader is, none the less, to lead, not merely to glory in and profiteer upon his chance, but deliberately to accept the leadership, make conscious to himself and to the world the end he is being driven toward and boldly and strategically to organize our very artful science into a socialized social service.

The Goal of the World.

What is the end we and the world are being driven toward?

The idea that is being burned and bled into mankind in this fierce crisis is, that it is nations, not merely armies, that make war; that it is the people, the whole breed, not only fighting men and the favored few, that must be fit to survive—whether in war or in peace; and that hereafter preparedness will consist in the development of a general all-round good condition of the race. In a word, we are being shot, shelled, gassed, taxed and scared, not back, but forward to the social point of view.

The million Englishmen rejected for the front in France—the third of the English people unfit to fight, were equally unfit for the service to which they were sent back behind the lines. They were unfit mentally, physically, normally, to fight, to work, to breed, this rejected third, and I can imagine, can't you? the condition of the two other thirds.

The English people are unfit, and the English people are typical.

We have in California a warden, James A. Johnson, who discovered that the "bad men" in his penitentiary, the troublesome prisoners, were practically all sufferers from bad teeth, bad eyes, bad ——— other organs. They were unfit. He had their physical defects attended to, and his troubles with them were over. Most of the "bad" prisoners became "good." They were fit.

Someone spoke of it as "good work."

"Yes," said the warden, pointedly; "it is good work, but late! Too late!"

If it had been done in time, those prisoners might not have been there at all. That is what he meant, this wise warden. He was suggesting the scientific thought that perhaps we imprison men and hang them for having a toothache or for not having glasses. He was suggesting that perhaps the dentist, the oculist and the physician may take the place of the warden, and of the policeman, and of the criminal judge after the war.

Dr. Ebersole's Plan.

And Dr. Ebersole, a truly leading dentist, has suggested how. He has suggested that we deal early with weak or sick children, instead of late with bad men and women.

You know his report upon "The Experiments Conducted in the Cleveland Public Schools for the Purpose of Ascertaining the Value of Healthy Conditions of the Mouth." It shows that the United States, the leader in dentistry, is as "bad" as England. Ninety-seven and one-half per cent of the public school children of this country have diseased or faulty mouths. That is nearly one hundred per cent, nearly three-thirds of our young people.

A series of experiments on 27 children showed an average increase in working efficiency of 99.8 per cent. Nearly 100 per cent again. How did he get this result? Easily. "The increase (of fitness) was due," says Ebersole, "to the correction of the faulty conditions of the mouth and the teaching of the correct care and use of the same."

Read the individual records in this report on those 27 cases. Remember that they represent millions (nearly 100 per cent) of our children. Note well their physical, mental and moral condition before and after the treatment, and you will achieve for yourselves some sense of our opportunities as dentists to beat the hospitals, jails and asylums and to contribute to the development of a people fit to fight. And, let me say, in passing, that a world of peoples perfectly prepared for war, would be not only prepared also for peace, but they would be too intelligent, too scientifically lead, to have wars. For wars are merely bad cases of malocclusion due to determinable causes and therefore curable, whenever we are ready, we scientific leaders to lead to the application to *war* and *poverty, prostitution, vice* and *crime,* of the methods of prevention used now, for example, by us orthodontists.

Experiences in Bridgeport.

The Dental Committee of the Bridgeport Board of Health in the report of results of work done in the St. Vincent Orphan Asylum, gives another boost, not to our pride, but to our sense of useful, optimistic obligation; to practice and to teach prevention.

Dr. Fones had prophylactic work done upon those orphans. Dental nurses cleaned the children's teeth and mouths thoroughly twice a year for four years. Decay was decreased from 85 to 15 per cent. And the cost, gentlemen, was 80 cents a year per child.

	1907 1908	1908 1909	1909 Nov. 1910	Nov. 1910 Apr. 1911	Apr. 1911 Apr. 1912	Apr. 1912 Apr. 1913	Apr. 1913 Apr. 1914	Apr. 1914 Jan. 1915
Diphtheria	6	2	1	0	0	0	1	0
Mumps	8	3	10	4	0	0	0	0
Scarlet Fever	17	8	12	8	0	0	0	0
Pneumonia	3	5	4	6	0	0	0	0
Measels	24	50	40	25	0	0	6	0
Tonsilitis	19	16	8	3	0	0	0	0
Whooping cough	7	2	2	0	0	0	0	0
Chicken pox	15	17	10	6	0	0	0	0
Croup	4	0	0	0	0	0	0	0
Tuberculosis of eye	—	—	—	—	1	0	0	0
Tuberculosis of lungs	—	—	—	—	1	0	0	6
	103	103	87	52	2	0	7	6

The table of statistics * which this report carries and which indicates that the mouth is the opening to other evils and to other reforms. I do not want to exaggerate the importance of one profession and I do want to emphasize the importance of the physician also, and the oculist, and the teacher, and of all the servitors of democratic society, but the results of Dr. Fones's care of the mouths of those orphan children do, as a matter of scientific fact, indicate that, not only caries, but diphtheria, mumps, scarlet fever, pneumonia, measles, etc., etc., diminished and finally disappeared from among those children under dental treatment.

Dr. Ebersole's results *also* show striking improvement in general health. These two experiments are leads for us leaders in our leading profession. We are busy upon *repair* work. We are busy, and we are late, like the warden. Dr. Fones and Dr. Ebersole began early upon children. Of course they, too, are late. They, too, are repairing damage done.

As a citizen I have been lead by my professional training in scientific methods to see that we must as a nation go farther back; we must begin with the parents and we must correct not only the teeth, but the faulty disease-bearing social and economic conditions which depress the families of the American people. Upon that job, however, all the professions must meet and labor together with statesmen and with the people for a scientific treatment of all forms of malocclusion.

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*Work was started in November, 1910, and in April, 1911, the mouth of the last child has been put in order. Study the above table and note that for nearly four years the diseases of childhood have been practically eliminated. The six cases of measles occurring during 1913 were caused by a new child whose mouth was in bad condition on entering and the children infected were all in need of additional dental service. The one case of diphtheria was also from a new child with bad teeth.

But to-day I am a dentist meeting with dentists at a convention of orthodontists, the leaders of a highly specialized profession. What can we, as leading specialists, lead to?

Municipal Clinics Advocated.

We can follow and we can thus lead dentists to follow the lead of Dr. Fones, Dr. Ebersole and others, toward the democratization of dentistry and especially of preventive dentistry. We can support and promote other such investigations, spread some knowledge of the condition of the mouths of the people and of what the *meaning* is of foul mouths to the public mind, to public and private morals and to the physical strength of the American stock. We shall have to go on with our private practice, doing our belated repair work for the select few who can pay the price determined by a social condition in which the demand for dentists is well-nigh universal, and the regular supply very, very limited. And we shall have to go on making our foolish war, I suppose, upon the quacks who are the natural products of the abnormal dental market. War, even the war of the dentists, will continue so long as the causes of war continue. And so the quack, the irregular grafting, painfully painless dentist will continue to maltreat the poor so long as ignorance and poverty exist. But we can see, with our scientific insight, that we can best fight the dental quack by making war upon ignorance and poverty. That is the great war, and our part of that great war is to labor steadily, out of office hours, back of the lines, to induce all cities, counties, states and nations to follow the lead, of Bridgeport and Cleveland, Detroit and Buffalo, and the California penitentiaries.

I say cities, counties and states because, as a citizen again, but with a professional eye upon the deeper lying economic problem, I want to see all these problems of democracy solved democratically, by the people, not by philanthropists, not by charity. So I will suggest that along with our individual propaganda of dental knowledge and scientific methods, we urge on the taxpayer, provision for the training of dental nurses to be employed in nurseries, homes, schools and colleges, with dentists to supervise, correct and repair.

This is our special part, as citizen-dentists, in the general social task, as I see it; and the experiences of England and of Europe and of the United States army with soldiers' teeth, indicates that it is a great part. But as leaders, as strategists, we shall be fit and fine if we remember always in all humility that our part is only a part of the whole new vision which is breaking through the storm of this dark world war—care for the people, regard for the race; a sense of the need and of the desire for the improvement of the breed of man.

Discussion of Dr. Suggett's Paper.

Dr. B. E. Lischer, St. Louis, Missouri.

The very title of the paper to which we have just listened is suggestive of the future, a vision of the dentistry that is yet to be, and it implies that the practice of to-day is not all that is desirable. Indeed, if one were to formulate an equally terse phrase with similar regard for alliteration, one might speak of present-day practice as "Dollar Dentistry."

Democracy.

But "Underneath all now comes this word, turning the edges of the other words where they meet in politics, art, science, commerce, religion, customs and methods of daily life, the very outer shows and semblances of ordinary objects——

"The rose in the garden, the ax hanging behind the door in the outhouse——

"Their meanings must all now be absorbed and recast in this word, or else fall off like dry husks before its disclosure.

"The politician turns round upon himself. Like the scientist, he acknowledges his brain baffled by the problems; he reaches his hand for help to the hand of the people;

"The commercial man turns round; the firm ground gives way beneath his feet also; to give now seems better than to get—and what sort of trade motto is that?

"In all directions gulfs and yawning abysses,

"The ground of society cracking, the fire showing through,

"The old ties giving way beneath the strain, and the great pent heart heaving as though it would break——

"At the sound of the new word spoken——

"At the sound of the word *democracy*."

Professional Policy.

Dr. Suggett has called our attention to a number of facts that are fundamental to the formulation of professional policy. The problems involved are very clear and may briefly be stated as follows:

First—Professional policy ought always to be in advance of legislation and should guide the wider applications of practice. Representative organiations, particularly national and state societies and institutions of learning, should always regard assistance in this matter as a sacred obligation.

Second—The dire need for the extension of dental service to all the people has been conclusively demonstrated. "We must search our hearts and confront our traditional optimism with the brutal facts of life as it is." We must universalize democracy.

"A few decades ago we might have turned our backs contemptuously on such a thought, but an enlarged experience of the world and a recognition of imperfections in our own political and social life have made us more humble and thoughtful. We are beginning to realize that democracy has been more a faith than a reality."

Third—Educational institutions must be expanded and made more truly representative, and organizations like our own must urge them to advance the status and increase the facilities for the teaching of dental science.

"Institutions criticize themselves by their results, just as do machines, and blindness to the nature of these results cannot be expected of rational beings whose happiness is bound up with them. So long as the conservative cannot demonstrate that our institutions are perfect, he must expect this constraint inspection of the social machinery. It would indeed be strange were it otherwise. The wonder is that, with such obviously faulty results, the amount of complaint has been so small. The reason for this relative paucity of complaint has, of course, been psychological. Very few individuals are able to separate themselves from the institutions of their day sufficiently to step back and watch their working. Such an act requires a certain degree of abstraction, a consciousness of institutions as human instruments which can be changed. Yet this objective, shrewdly critical attitude is becoming pretty general with the increase of education and the growth of democratic sentiment, and bids fair to spread to the masses who have, until now, been in society, but not genuinely of it. The consequences of all this is the rise of a critical, experimental spirit which is not enamored of institutions, but studies them in a scientific way and is little likely to be put off with choleric assertions that man has stumbled upon the best of possible organizations. Every feature of society must, from now on, defend itself before the bar of a reason steeped in facts and hopeful of improvements."

Fourth—The reason why the masses do not now avail themselves of dental services is because the organization of our industrial society has been on an individualistic, *laissez faire* basis, which tends more and more toward "wage serfdom," poverty and ignorance.

As long as we regard human labor as a commodity, and fail to consciously organize the constituent elements of our social and economic life, we must expect disorder, waste, anti-social competition and unmerited poverty; nor can we "hope to tap new energies which are now latent," or "make labor-saving devices really saving of labor," or "procure a fair degree of leisure for each individual," or "achieve a better distribution of human costs."

Thanks to the Reconstruction program of the British Labor Party, we are now headed towards a new world. "It has electrified liberal America as the speeches of President Wilson have electrified liberal Europe. And if liberal Europe looks to Wilson to-day as a Moses, we in turn look to the British Labor Party's program as the Ten Commandments. Yet the strength of them is that they are not commandments, nor dogmas, nor final things, but a successful attempt to strike at the roots without attempting the impossible, and to be constructive without being trivial and merely ameliorative. It is that thing for which we have waited so long—a program practicable enough for to-day and to-morrow, yet radical enough to bring our ultimate destination within view."

"The four pillars of the house that the British Labor Party hopes to erect, resting upon the common foundation of democratic control of society in all its activities, may be termed:

"(a) The universal enforcement of the national minimum; (b) the democratic control of industry; (c) the revolution in national finance; and (d) the surplus wealth for the common good.

"Is it a dream?
Nay, but the lack of it the dream,
And failing it, life's lore and wealth a dream,
And all the world a dream."

Dr. R. Ottolengui, New York City.

There are two lines in this paper to which I would respectfully take exception. All the rest of it I merely endorse. The essayist says, "The American dentist is the leading dentist in the world, and the leading American dentist is a good orthodontist." This statement reminds me of the man who had married a second time. About two weeks after the honeymoon, he took his new wife out for a buggy ride, drove to the cemetery and visited the grave of his first wife. Looking down on the grave, he remarked, "She was the best woman in the world. She was the best woman in the world." Wife number two remarked gently, "Charles, you mean she was one of the best women in the world." "No, I mean she was the best woman in the world!" and the honey part of the honeymoon ended right there.

The Cleveland Experiment.

I would now like to discuss briefly some of the examples as referred to by Dr. Suggett. He calls our attention to the experiment made in Cleveland and gives us some statistics in regard to that experiment. Let me say then that if we are to democratize orthodontia, we must not rely too much on that sort of experiment. Experiments should be carried on along lines as nearly parallel to the actual conditions as possible so that the results will be real and not imaginary. We had statistics in regard to the Cleveland experiment which were not literally correct. They were correct as applied to the 27 children, but omitted from that calculation was the fact that at the start there were some 80 or 90 children. Little by little these children dropped out, or were left out, and only 27 went through with the entire curriculum upon which these statistics were based.

The Brooklyn Experiment.

For this reason a new experiment was tried of which the essayist is apparently in ignorance. This was undertaken by the Second District Dental Society, in Brooklyn. We considered the Cleveland experiment inadequate because we were going to talk to the municipal authorities about the effect the dental service would have upon the school system and upon the scholars. It seemed to us necessary to conduct an experiment in such a way as to appeal to the municipality as practical. Consequently, we abandoned the idea of utilizing a number of dentists, especially skilled or fitted or inspired or enthused to do this work. Nor did we select a limited number of children who were anxious and willing to go through with the test and then base statistics on work done in that way.

We went to the Board of Health and said, "Here is a list of fifty dentists, located in all parts of the city of Brooklyn. Will you send two children to each of these dentists from any school you please, from schools which would be most convenient for the children? Will you keep their scholastic records before you send them, and will you keep their scholastic records during the time of their attendance, and will you give us the result after we have taken care of these children for six months?"

We found out at once, when 100 children had been selected and told that they could have free dental service, that nevertheless they did not appear at the offices. We showed by this experiment not only the value of dentistry to those who would accept it, but the difficulty of applying it in a school under a system of this kind. By analysis we discovered that one reason why these children did not come was because many of them could not afford the time or car fare. Thus the dentists agreed not only to give services, but to pay their car fare. In spite of this, however, we never did render service to 100 children any more than the Cleveland dentists did. However, we did serve 68 children and about half of these were reported by the Health officers to have improved physically, mentally and scholastically.

My own personal experience was peculiar, my office being in New York. The two children first referred to me failed to reach my office at the first appointment. I notified the Board and two more children were allotted to me. Then on the following Saturday, four children arrived. As they were willing to come, however, I did the work. The point of interest to us is that out of the four sent to me, one had a pronounced Class III and one a pronounced Class II deformity. I thus immediately arrived at the relation between dentistry and orthodontia in this school work. While it was possible for me to relieve the child from suffering in the Class III case by treating the decayed teeth, nothing that I could do as a dentist in six months would correct that child's mouth, and as the child had a very bad masticating apparatus, the filling of her teeth would hardly be expected to improve her physical condition. Most of the statitsics that we have had are based on the examination of the mouths for caries. If a similar investigation were made in regard to malocclusion, I believe that the magnitude of the orthodontic work required by children in the public schools would be something appalling and there would be added difficulty of instituting proper prophylactic measures.

Another difficulty in democratizing either dentistry or orthodontia is the size of the community, especially a large city like New York, where we have eight hundred and fifty thousand public school children. The children do not reside long enough in one locality to carry through the system of treatment, and the only solution to this problem is compulsory dental service in an infirmary located in the school building.

The Bridgeport Experiment.

This week we are to dedicate for the first time I believe in the history of the world a monument placed in a public park in memory of a dentist. I firmly believe and prophesy that a second monument will some day be placed and dedicated in memory of a dentist. After the Cleveland experiment had failed to satisfy hard headed business men in other parts of the country that dentistry in public schools would be worth the cost, Dr. Fones undertook another experiment in Bridgeport. He trained a number of girls to do prophylactic work and then put them to work in the schools. The first year they gave him $5,000 for this experiment. The second year they gave him $10,000. The third year they gave him $12,000. This year he asked for $20,000 and they gave him $35,000, proving in a practical way that the holders of the municipal purse-strings had become convinced. Dr. Fones will shortly be able to publish the result of five years of this kind of work, and when these statistics are published, we will have a genuine foundation upon which to argue as to the advantage of democratizing dentistry.

Dr. Julius Hovestad, Boston. This subject is extremely interesting to me. About fourteen years ago I showed before the Massachusetts Dental Society the beneficial effects on children of the proper care of their teeth. I had then a record of eleven years' work. Dr. A. C. Fones in his last publication on "Mouth Hygiene," and several other writers, have given me credit for giving out the first record of this work. When I started the work in an orphan asylum I found that there were fifty-five patients from the ages of two to sixteen or seventeen years. There was a great deal of trouble among the inmates. There were diseases of all kinds. The home was never free from some form of disease of some kind or another, and many times they had some very serious contagious diseases. It took me just about four years to wipe that out completely. My record which was published in the *Dental Cosmos* in January, 1905, shows that the expenses for the home for medicine and medical services were reduced to something like three to eight dollars a year, whereas these expenses in previous years ran up to several hundred dollars. Contagious diseases were entirely wiped out. I think that was a remarkable record. I did not know what I was accomplishing at the time; I had no idea that I had obtained such results till one day the superintendent, when I asked for the records, showed me these figures.

I really think that we can believe the report presented by Dr. Suggett, and that these things are possible because they have been proven by many other men besides him.

Dr. George F. Burke, Detroit, Michigan. I regret very much to hear Dr. Ottolingui speak disparagingly of the mouth hygiene work done in Cleveland. I had the good fortune to visit the Marion School during the period that Ebersole was doing the work with his class on mouth hygiene.

Not being in possession of the facts, I would not care to question the results of his findings. But after talking with the principal, a Miss O'Neill, and the examining physicians, I was favorably impressed with the great value of this work in an educational way. He showed that as a result of cleaning up the mouths of his class, together with proper personal care and instructions in masticating their food that these children improved both physically and mentally. The results of this experiment directed the attention of dentists and physicians to the value of this work, and from an educational standpoint, Ebersole's work had great value.

In Irving Fisher's book entitled, "How to Live," reference is made to Ebersole's work in Cleveland, and credit is given him for his efforts, which, in the minds of many, he richly deserves.

Dr. R. Ottolengui, New York City

I rise to correct an erroneous impression on the part of the previous speaker. I do not think the stenographer's notes will show that I criticised the Cleveland experiment at all. I was heartily in sympathy with Dr. Ebersole; I was friendly to the movement. What I said was, and I say it again, that the experiment was not convincing because the manner in which it was conducted was outside of lines in which such work should be conducted in schools. I did not say the statistics were incorrect; they were absolutely correct as far as the twenty-seven children were concerned who went through the experiment. To Dr. Ebersole belongs the credit for originating this movement, but there was a fault in the plan which left municipal authorities unconvinced. The first experiment was not as good as the last.

Dr. Suggett (closing).

I am not surprised that children did not come to Dr. Ottolengui for charity service on their teeth. Children do not like dentistry and their parents do not like charity. Everybody detests charity, fortunately; it is not a solution of any problem.

But children go to school and they are there to be taught what they should know. One of the things that should be taught them, I hold, is the care of their teeth; as a scientific solution of the problem, not only of the teeth, but of other evils which develop out of bad teeth.

As to the effectiveness of the solution, the cautious doctor warns us that the few experiments we have made are not enough to establish the optomistic conclusions which the experimenters and I have drawn. That is true. We have not made as many experiments as we should. That is my point. I want more such experiments started to make sure we are right; to establish scientifically our theory that expert, free instructions in the public schools in the practical care of the children will enable them to learn their lessons better and to be more optimistic and capable and clearheaded than our generation. But I want to leave with you this argument for human cheerfulness, if not for scientific optimism, to wit: all the knowledge we have and all our experience; all our experimenters and all our experiments so far made, go to show that we are on the right track.

The Law of Occlusion and the Normal Orthodontia

By A. LeRoy Johnson, Springfield, Mass.

In modern orthodontia there has developed a tendency to absolute methods and absolute claims as to the results of treatment. And it requires no violation of reason to see in such methods the logical extremes of the doctrines upon which orthodontia was founded. With its inception in mechanical dentistry, during that period of philosophic thought when diversity of form was entirely attributed to environmental influences, such conclusions as the following were natural. They are the dominance of the mechanical influence of cusp relation in the development of occlusion; the inherent tendency of all organisms to evolve a definite type, *harmonious in design*, and the *equal* potentialities of development of *all* organisms. In the light of advancing science and a deeper knowledge of the forces governing occlusion derived from practice, we can no longer allow such doctrines to pass unquestioned even though they still express an element of truth.

The masticatory apparatus is a living part of a living thing and so is subject to the same general laws as are other parts of the organism. Hence the knowledge of its growth and the development and the interpretation of such knowledge in terms of practical utility must conform to the methods and material of science in general.

The following is an attempt to express in terms of science the fundamental principle of orthodontia and the nature of the normal as it refers to the species and to the individual. In the subject matter is embodied a criticism of the doctrines referred to above.

What is Scientific Knowledge?

The line between common knowledge and scientific knowledge is not easily drawn. To say that science is organized knowledge is not enough, for the commonest acts of every day life are, in greater or lesser degree, organized. It cannot be said that science is the more exact, because much common knowledge is exact. Comon knowledge may be just as precise as scientific knowledge but in order that it be scientific it must be precise. Science reduces other knowledge to the same degree of precision. From one point of view science may be called "an extension of preception by means of reasoning." It is prevision. A child who knows that a lighted match thrust into water will go out, and the astronomer who, having calculated a transit of Venus, can delineate the black spot entering the sun's disc, do the same thing. Each has a preconceived impression of what will happen upon fulfilling certain requisite conditions. The difference is in the complexity of the process needed to see the result. In reality it is a difference in degree only. One is merely an extended and perfected form of the other. Science defined, is "knowledge which has been systematized and formulated with reference to the discovery of general truths or the operation of general laws." Science exists because in order to foresee the result of a complex process it is essential that the knowledge referring to this process be arranged in conventional form.

The material of science is accumulated as the result of observation, comparison and experimentation and the methods employed are referred to as either qualitative or quantitative. The prediction that a piece of lead is heavier than a piece of wood of equal size, is the qualitative method. It exhibits certainty but not completeness of foresight. On the other hand the prediction that water will freeze at 32 degrees Fahr. shows fore knowledge not only of the effect to be produced but of the magnitude at which the effect will be produced. This illustrates the qualitative and quantitative methods combined. The quantitative method applies to a definite measure to phenomena as in the use of thermometers, scales, dynamometers and as in the modern methods of experimental analysis. Hence, only in proportion as knowledge becomes quantitative is it especially scientific. Only in the degree that it is measurable is it scientific in the highest sense and do its previsions become complete as well as certain.

From another aspect passing from qualitative to quantitative is passing from inductive science to deductive science. Inductive science is qualitative: it is reasoning from the individual to the universal. Induction gives general principles derived from the observation of individuals as in the formation of a natural law. Deductive science is quite the opposite from inductive science. It is reasoning from the general to the individual. Deduction gives explicit knowledge; it measures. Although deductive and quantitative methods are not coextensive, all quantitative prevision is reached deductively. The first stages of all science is inductive but after continually applying this method with constant results, deductively the results of observation may be approached. The history of physiology and morphology show many instances of the legitimate use of this method. The knowledge of the presence of the vascular and nervous system was inductively established and from this it has been possible to draw certain general deductions.

Thus do common knowledge, qualitative and quantitative science stand in the orderly sequence of their evolution. It is essential to grasp the significance of this sequence and also the distinction between qualitative and quantitative methods of scientific work. The quantitative work that has been done during the last quarter or possibly half of a century has upset many of the philosophical generalizations expressed even now in orthodontic literature.

Natural Law.

From the definition of science it is clear that the selection and utilization of knowledge in each branch of science is determined by its relation to the general truth or law which gives to a particular science its distinctive character. In short all science is founded upon a general truth or law. In organic science the basic principle is referred to as a natural law.

A natural law, or law of nature, means nothing more than that there exists a uniformity in a certain phase of natural phenomena. It is the result of inductive or qualitative study *i. e.*, from the observation and comparison of many individual cases there is evident a certain uniformity of phenomena. In the words of Herbert Spencer "A natural law is the uniformity seen in the diversity of organic forms."

The Law of Occlusion.

Orthodontia like all other branches of science is founded upon a general truth, a natural law. As a result of the study of many organisms, from the observation and comparison of the growth and development of the masticatory apparatus of the individuals of many species, there is seen to be a certain uniformity of phenomena. From the view-point of inductive reasoning and as a result of qualitative study the order of sequence of the phenomena is seen to be so invariable under normal conditions that a uniformity is readily recognized. And since the mechanical relations of the occlusal inclined planes of the teeth, typical for the species, is the goal of the growth and development of this part of the organism, the uniformity, the natural law we call, the "Law of Occlusion." Therefore, the law of occlusion is the general truth, expressing a uniformity seen in the diversity of organic forms, upon which the science of orthodontia is founded. It is the basic principle about which the knowledge of the growth and development of the masticatory apparatus, the subject matter of orthodontia is systematized and formulated into a science.

Normal Occlusion.

It is not an uncommon procedure in practice to confine the study of the growth and development of the masticatory apparatus to a consideration of the occlusal relations of the teeth. A conception called "normal occlusion" is the measure laid upon each individual case, and as the occlusal relations depart from this "normal occlusion" the teeth are said to be in "malocclusion" and requiring treatment. To arbitrarily determine the ideal relation of each individual inclined plane and then, by virtue of the plastic nature of bone, to mechanically conform all variations to this ideal relation, is, like many half truths, beautifully simple. And in this comparatively easy way the question is often disposed of.

The obvious unsoundness of such procedure is further emphasized in the diversity of opinion manifest in the literature as to the idea conveyed by "normal occlusion." To some it is a conception derived from the study of dead form, prehistoric skulls and lower species; a purely mental concept; a hypothesis, when applied to modern man. To others it is a condition of greatest occlusal contact for the individual case; while a few consider normal occlusion as synonomous with natural occlusion. However the latter do not confine their exposition to the individual instance.

This confusion of ideas is due to a loose interpretation of terms and to the fact that studies of harmonic conditions of development have been limited almost entirely to organisms, of a different nature or living under different conditions from the human organism of to-day. The conception of the normal has not been the result of evidential reasoning according to scientific standards.

Normal?

What then is the meaning of the word normal? As the term is used in different branches of science slight variations in sense, appear, according to the nature of the material it is expressive of, and, also, as emphasis is put upon the words chosen to convey its meaning; as rule, standard model, type or pattern. In chemistry normal denotes a solution of definite character; in geometry normal refers to any perpendicular line; in economics normal and natural are often used synonomously but the use of the word natural invokes certain metaphysical assumptions which are not connoted by the term normal; in biology normal is the balance of activity, growth and repair. Although the word is used differently in the different sciences, in each science its use conveys a definite idea. So in orthodontia where the word normal plays such a vital rôle in terminology it is essential that it be used in as restricted sense as possible.

In Webster we find that normal "is according to, constituting or not deviating from an established norm." and that a "norm" is a rule or authoritative standard. As used in the organic sciences "normal" is "according to; constituting or not deviating from a standard or rule which is observed or claimed to prevail in nature." The normal then is not synonomous with natural: it is a standard derived from a study of the natural.

Then if normal occlusion is to be a scientific guide in orthodontia, it must be a standard derived from a study of natural forms. Moreover it must be a standard derived from a study of natural forms as manifest in the human masticatory apparatus as it lives to-day in the 20th century. It is not a standard derived from the study of fossil forms, prehistoric skulls and lower species. A knowledge of such material is included in that larger concept the law of occlusion, and is necessary to an understanding of the phenomena encountered in the study of the human denture. But the material which determines the standard, the normal, which is to be taken as a tangible guide in diagnosis must be derived from the material we work upon.

Is Normal Occlusion Important?

The condition of the organized world is not a fixed condition; it is constantly changing. The man of to-day is not the man of yesterday. Changed conditions of living have caused some parts and organs to become less essential to existence. Until as Bateson says, "We animals, live not only by virtue of, but also in spite of what we are. Any instinct or organ may be of use; the real question is of how much use it is?" In view of the diversity of form manifest in the human masticatory apparatus we may well question "of how much use it is?" Do not misunderstand me. I do not infer that normal occlusion is not essential, but that in the life history of the human organism and the present condition of its denture, there is evidence of its not being as vital to existence as it was and is to those organisms from which the popular conception, the old orthodox ideal occlusion has been derived; the same conception that has been responsible for the belief in the dominance of the mechanical influence of cusp relation in the development of the dental arch. It seems quite obvious then that the conception of normal occlusion, typical of the species, as a scientific guide must be the result of the study of the masticatory apparatus of many human beings, living in states of health under the complex conditions of modern civilization. It is a standard derived from statistical investigation.

Variability of Organisms.

To-day the most conservative thinkers do not question the natural tendency of all organisms to vary. The structural relations of one are not identical with those of another. Hence in orthodontia we are forced to believe that the normal occlusion for the species, *i. e.*, an average typical condition of cusp relation, determined by statistical investigation, and the normal of the individual are not necessarily the same. In the majority of cases we may reasonably expect to find a natural difference between the species normal and the normal of the individual. And thus we are led to one of the most momentous questions of orthodontia, to determine the normal of the individual; to ascertain the range of variation from the normal of the species which is consistent with the most complete realization of the growth and developmental possibilities of the individual organism as a whole. A definite solution of this problem is not anticipated in any instance; in fact the absolute claim is unwarranted. But because now it seems hopelessly beyond our reach is no reason why we should not face the facts of science, utilize its available material and conform our efforts to its methods.

The Problem of the Normal for the Individual.

To determine the normal of the individual is a difficult problem. It involves the consideration of phenomena fundamental in organic life. And a scheme of investigation or system of diagnosis which will indicate the individual normal and so in a degree at least anticipate the possible and the impossible in treatment, must be built upon a knowledge of normal and pathological processes, as they are expressed in growth and development. We can not postulate the rôle of pathology as an etiologic factor of malocclusion until we are familiar with normal processes. These latter include such fundamental problems of biology as the interdependence of function and structure; variation and adaptation; heredity and the unity of the organism as a whole. In the material of science relating to these so-called normal processes the individual element in the organism is clearly emphasized.

From the view-point of philosophy the life of the individual organism is a continual balancing of external by internal forces. Fisk says "that it is the continuous adjustment of internal to external conditions." Spencer expresses the same thought in different terms. Thus each considers two kinds of equilibration briefly designated as internal and external. Fisk referring to the internal processes says: "We see that direct equilibration which consists in continually arranging all the units of the organism in accordance with their physiological polarities, exemplified alike in heredity and in the correlation of growth. The dwindling and final evanescence of organs which are disused is due to the fact that the nutritive material is all needed by the other organs which are in constant use." Here Fisk foreshadowed in philosophy the research work of recent years in the necessity of considering the organism as a whole in the endeavor to determine the normality of any of its parts. Philosophically considered a normal individual organism is one expressing an adjustment of internal to external forces consistent with the most complete growth and development of the organism, as a whole. Certain organs develop and atrophy to maintain this equilibrium.

The Problem of Adaptation.

In studying the question of the individual normal it is of particular interest to note the change in the attitude of science to the problem of adaptation and to follow the investigation in physiological chemistry and heredity.

For several decades after Darwin the literature was filled with philosophical speculations relative to the phenomena of adaptation. Students of evolution found the study of it so much more interesting and impressive than that of specific diversity that they seem to have seen nothing else. However during this period very little progress was made. And it was not until the introduction of experimentation on the basis of the quantitative method by the school of experimental biologists headed by Jacques Loeb that definite progress was made.

Approached from a new angle the problem of adaptation appears in a very different light. Loeb says that, "authors have too often spoken of adaptation to environment where environment was not responsible for the phenomena." And "while it is possible for forms with moderate disharmonies to survive, those with gross disharmonies cannot exist and we are not reminded of their possible existence. As a consequence the cases of apparent adaptation prevail in nature." In another place he says: "Those organisms live and develop that are free from the grosser type of disharmonies; the rest are doomed on account of a gross lack of harmony of the parts. Those latter we never see and this gives us the erroneous conception that harmony or design is the general character of living matter. In his work "The Organism as a Whole," the evidence and references are clearly set forth from which the conclusions as to the lack of design in living nature are derived.

In the work upon the internal secretions, physiological chemistry is applying direct and penetrating methods to biological problems. Mathews says:

"The body is an organic whole, and these so-called organs of internal secretion are not unique, but the bones, muscles, skin, brain, and every part of the body are furnished internal secretions necessary to the development and proper functioning of all the other organs of the body. Such a scheme to be complete must embrace every organ; only the barest beginning has been made in this study, so important, so necessary for the understanding of development and inheritance. The problems of development and inheritance cannot be solved until these physiological questions are answered."

It is claimed to have been demonstrated that what has appeared as adaptation when unknown has turned out to be a result of the action of a definite chemical substance circulating in the blood. Leo Loeb observed that "the corpus luteum of the ovary gives off a substance to the blood which alters the tissues in the uterus in such a way that contact with any foreign body induces the same decidua formation as does the egg." Steinach has shown that "the wonderful mating instincts seem to be due to definite substances secreted by the sex glands." Lewis has shown "that if the optic cup is transplanted under the skin of a young larva into any part of the body the skin in contact with the optic cup will form a lens; it looks as if a chemical substance from the optic cup were responsible for the formation of the lens."

In the work of the Mutationists and students of Mendelian Heredity there is evidence that disharmonic conditions of development may express alterations in the Hereditary Constitution. In the *Scientific Monthly*, May, 1918, Morgan says:

"A specific gene may be essential to the normal development of a certain organ, which organ through an internal secretion may affect other parts of the body, or even the body 'as a whole.' If, for example, the development of the thyroid gland were known to be dependent on the presence of a certain gene (amongst all of the others involved in its formation) a change in the postulated gene leading to the arrest in the development of the thyroid gland would, owing to the lack of a sufficient amount of some internal secretion of that gland, produce a malformed child with all of the various stigmata of the cretin."

If this be true then the factors of heredity cannot be eliminated even though the phenomena directly responsible for the development of a deformity can be traced to the abnormal activity of a ductless gland.

It is neither necessary nor wise to accept in detail the conclusions of any one man or class of men in an attempt to establish a scientific truth.

In experimental biology it is never certain that all conditions are constant except the one being studied. Consequently it is quite a common circumstance for two investigators of ability to arrive at conclusions diametrically opposed. Furthermore it is always difficult to determine the value of evidence and particularly so when the alleged phenomena are of exceptional significance. The criterion of science in its three phases observation, comparison, and experimentation is not always applicable in the study of the life phenomena of the human organism. Hence the best that we can do in many instances is to apply the "test of inconceivability" to the evidence presented; believing things when we must but not before.

Heredity of Environment.

However from the most conservative standpoint of accepted scientific thought the doctrines proclaimed in the early days of modern orthodontia are now known to be inadequate. The evidence of science is explicit that the masticatory apparatus is a dependent and living part of a living organism; that it is controlled in its growth and development by the same factors which control the growth and development of the organism as a whole, and that it is expressive of both physical and psychical phenomena. We can no longer assume that all individuals possess equal possibilities of development. "Studies in modern genetics are emphasizing the immense, the overwhelming importance of heredity in both phylogeny and ontogeny." (Conklin). And it must be remembered that the directing and guiding factors of development are present in the organization of the germ cell, while environmental factors exercise a stimulating inhibiting and modifying influence on development. Heredity fixes the possibilities of development; it sets bounds beyond which we cannot pass. Nor can we assume the inherent tendency of all organism to evolve a definite type harmonious in design, in the face of evidence of natural disharmonic development and the possibility expressed upon good authority that such disharmonies may in rare instances be of the character of hereditary mutations.

The relative importance of heredity and environment is not the same in the development of man as in the development of the lower animals; environment exerts a larger influence because of the longer period of development while heredity plays the same part as in the lower animals. Although most deformities are considered as the result of extrinsic, environmental forces, the nature of the condition cannot be known without taking heredity as well as environment into consideration, because the character of a response to stimuli is determined by the organism. The forms which structures take on is not the result of either environment or heredity working independently. Conklin says, "We do not inherit disease but the factor which determines whether one organ is susceptible to a disease while another is not, may be an inherited factor."

Form development is the result of the interaction of forces determined by heredity and environment. Hence the etiologic factor of malocclusion is that which affects the organization of the organism or modifies the stimuli of the environment sufficiently to disturb the equilibrium expressed in normal development. A certain mechanical influence which will bring about a modification in the structural formation of the dental arch of one individual will not necessarily bring about the same arch formation in another individual. In each case we are face to face with the individual element.

The problem of orthodontia is a complex one. Founded upon the law of occlusion and concerned with the development of the dental arch of the individual organism it involves the most fundamental problem of biology. A conception of orthodontia limited to the mechanical relations of tooth forms, while alluring in its simplicity and the promise of the absolute, will not withstand the crucial test of practical utility, since it ignores the essential vital activity of life phenomena.

Discussion of Dr. Johnson's Paper.

Dr. Calvin S. Case, Chicago, Ill.

Mr. President and Gentlemen of the American Society of Orthodontists:

I found upon a careful reading of Dr. Johnson's paper that it is a difficut paper to discuss, because there seems to be no definitely stated conclusion or proposition relative to the principles of practice of orthodontia. This leads me to fear that I may make a wrong interpretation of the essay.

It is certainly interesting in the sense that it conclusively proves that the practice of orthodontia is the one branch of dentistry which leads investigating minds to realize the needs of a more or less familiar understanding of the principles of biology, and particularly the laws which remotely or otherwise have led to many dental and dento-facial malocclusions.

This subject (if I may be allowed to introduce a personal equation) was pretty thoroughly thrashed out in a paper and its discussion, entitled *"The Question of Extraction in Orthodontia,"* read before the National Dental Association in 1911.

The practice of orthodontia also must lead to a higher appreciation and study of facial art, now that the possibilities and opportunities of correcting the facial outlines in deforming protrusions and retrusions have been greatly increased by the somewhat recent acceptance and practice of "bodily movement."

I have wondered if it were not the main object of the essayist to give a warning to those orthodontists who are still following the arbitrary, cut and dry mathematical rules of practice, oblivious of individual demands? It is not strange in my opinion, that many orthodontic specialists at one time were premeated with misleading beliefs in regard to occlusion and malocclusion of the teeth, as the essayist has intimated, and of which it is not a far cry to say was because they were fed like birds with open mouths on a circumscribe quantity of false pabulum, outside of which all other teachings were "*verboten.*"

It is refreshing to see such manifestations as the paper presents toward an awakening to broader knowledge, founded upon established principles of scientific thought. While I cannot quite see the practical application of the lengthy scientific and philosophic dessertation apparently to define the meaning of science and how it differs from common knowledge, and to prove that normal occlusion of human dentures arose like other grand and perfect anatomical culminations through the natural forces of Nature, I have no doubt the essayist had a certain purpose in view, which may be that he felt the need of showing that the laws and teachings of science should be regarded as a dependable foundation upon which we may fearlessly rely, and feel at liberty—though it may not be what we were taught—to open our eyes and look out on the world of other thought and other teaching; and that if desired we may take long and much needed draughts from Nature's fountains, abundantly supplied upon every hand from the pens of eminent interpreters.

Normal Occlusion and Ideal Occlusion.

I think he endeavors to show that the equilibrated occlusion of the human dentures, known as normal occlusion, is not the ideal occlusion which formed so large a part of the earlier writing and illustrations of orthodontists, any more than physical forms of the human race individually follow the type of the Apollo Belvedere, but that it differs within the limits of its standard as people differ. Moreover, I believe it is generally conceded by scientific men that the inherited standard of dental occlusion has come down to us essentially unchanged through the ages from the prehistoric men of the old stone age, and kept in line through the law of natural selection (survival of the fittest), and its perfect adaptation to needs.

Even as far back as the "second inter-glacial period," 200,000 to 350,000 years ago, the forms, number, and relative position of the teeth and their occlusion were essentially the same as the standard normal occlusion of to-day. And though in the earlier stages of that vast period the jaws were of a heavier type, and the bi-maxillary protrusive prehensile mouths, enhanced by chinless mandibles, showed their distant descent from the anthropoid progenitors, the occlusion of the buccal teeth, their alignment and arch form—even the canines which had thrown off nearly all their carniverous characteristics—were all practically the same as to-day. I speak of this because the essayist infers that the normal occlusion of modern man differs from that of the prehistoric.

I am pleased to refer those who are interested in this department of science to a recently published work entitled "*Men of the Old Stone Age*," by Prof. Henry Fairchild Osborn, of Columbia University and U. S. Geological Survey.

Practical Occlusion.

In our strife to produce the highest possibility of our specialty by the accomplishment of the greatest good to humanity, if we are to regard this normal occlusion as a scientific guide in orthodontic practice in the same sense that health is the scientific guide in the practice of medicine, I am loathe to believe that the essayist, or anyone having the intelligence and higher sensibilities of humanity can wish us to exclude from our view the increasingly appalling number of dento-facial deformities which the attainment of a normal occlusion cannot possibly correct, and which appeal to us upon every hand for succor which we can so easily give, and too, with it an occlusion that is equally useful and often with greater chance of permanency of retention.

Many of the most strongly marked dento-facial malocclusions have arisen through the same biological forces of heredity that characterizes the normal and relatively harmonious, but unfortunately through unions of inharmonious types on the principle of hybridizing, and from other sources, closely related physical disharmonies are frequently stamped upon individuals whose psychological influences mar their entire lines, and whose beautifying correction from an artistic standpoint demands changes which should not be held subservient to the "law" of an idealized normal occlusion.

(It was here voted to discuss the papers of Drs. Johnson, Rogers and Mershon conjointly. Further discussion will be found further on.)

The Teaching of Orthodontia to Under-Graduates.

By Dr. Ralph Waldron, Newark, N. J.

The beginning of orthodontia, like many other sciences, dates back into the obscure past, and the art was subsequently practiced by those who were totally ignorant of the physiological functions of the teeth.

They knew that teeth move and change their respective positions, but they never considered such things as the etiological factors which caused deviation from the normal; like Topsy, "They knew they just grew that way," and we are not surprised when we find as late as 1897 one of the leading text books on this subject contains but four pages on etiology.*

The principal thing that attracted the attention of the dentist, was the ugliness of the mouth, and in his endeavor to better the appearance of the patient he extracted teeth or made some mechanical device, which naturally was very crude and usually clumsy; and I am very sorry to have to admit this condition exists to a limited degree to this day.

The making of orthodontic appliances used to be considered as mechanical dentistry, and was taught by the professor of prosthetic dentistry, who lectured upon this subject, not because he was unusually skilled in the science of orthodontia through practice, but because he could not pass it over to some other member of the faculty.

Luckily for all concerned, orthodontia became a distinct science, founded upon definite principals, with a diagnosis, and a well defined line of treatment, with a rational prognosis, through the energies, and studious thought of men like Dr. E. H. Angle, and many others who need no introduction to this society.

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*Kirk's Operative Dentistry. (1897 edition.)

These men labored long and hard, that orthodontia should not only survive, but should be classed as a *true* science, founded upon biological principles, and not merely a mechanical art.

Within the last few years our universities have become thoroughly convinced that orthodontia is a distinct and separate branch of dentistry, and have created a chair of orthodontia with a professor who devotes his time *exclusively* to the practice of orthodontia, and who has a separate staff of instructors in this science whose duty it is to instruct the students and supervise their ever-increasing clinics.

No man can sincerely dispute the fact that the study of orthodontia is post-graduate work if it is to be brought to the ideal, but this is not *always* possible, for the general practitioner of dentistry must undertake many of the cases which develop in his practice, especially if his practice is in a district far remote from a locality which can support an orthodontic specialist.

The departments of education in our various States realize this, and some have laid down a minimum course of study for all dental schools seeking to be registered by the State Board of Dental Examiners within their respective states, and naturally the colleges wishing to be credited in the various states live up to these minimum requirements, and some *greatly* exceed them.

Orthodontic Requirements in New York State.

The Board of Regents of the State of New York have set the following as the minimum of orthodontic requirements which they will accept from colleges seeking recognition, in order that their students may take the licensing examinations of the State of New York and be entitled to practice dentistry within that State.

The following is the minimum course accepted by the Board of Regents of the State of New York:

For the Third Year—Fifteen hours of recitation and lectures on orthodontia.

Fifteen hours of laboratory work on orthodontia—7 1-2 actual.

Actual time, thirty hours.

Credited time, twenty-two and one-half hours.

For the Fourth Year—Fifteen hours lecture and recitation on orthodontics.

Sixty hours laboratory work.

Actual time, seventy-five hours.

Credited time, forty-five hours.

The lectures to be upon the following topics, for three and four year: Historical sketch; consideration of former methods; technique of wire drawing, soldering, etc.; nomenclature and definitions; normal occlusion; forces governing normal occlusion; transition from deciduous to permanent denture; malocclusion; forces governing malocclusion; classification of malocclusion (Angle); etiology; benefits in correction of malocclusion; importance of the first permanent molar as a key to occlusion; the sizes, forms, interdigitating surfaces, and position of teeth in the arches; the line of occlusion; facial harmony and balance; process and membrane, including tissue changes incident to tooth movement; dento-facial orthopedia; consideration of instruments; anchorage and dynamics; adjustment of appliances; impressions and casts; treatment of Class I; treatment of Class II; treatment of Class III; principles of retention by classes; care of the mouth; office records and management of cases.

Co-related Branches of Teaching.

We have now arrived at an era of dental teaching when the various branches, distinct though they may be, must be so co-related and interwoven in their presentation to the student, as to make the entire subject a complete presentation.

The interdependence of the various subjects must be more and more forcefully placed before him. For example: The technique of wire drawing, annealing and tempering of orthodontic metals and alloys, are taught by the professor of chemistry and metallurgy; anatomy of the mouth and teeth are not taught by the professor of orthodontia alone, but also in the department of dental anatomy and operative dentistry, two years before he studies orthodontia.

The alveolar process and peridental membrane can be better taught in the department of histology, while diseases of the mouth are taught by the professor of that subject, and touched upon by almost every member of the faculty, whenever it bears upon his work. The technique of soldering is taught in the prosthetic dental department, and the student does this continuously more or less the first and second year of his college course; so that when the student has reached the third and fourth year, his mind has been so trained and he has become so skilled in technique that he is in a receptive condition to absorb orthodontia and the corelated dental subjects. In other words, the so-called non-dental subjects, such as anatomy, physiology, metallurgy, chemistry, bacteriology, histology, pathology and physics, also prosthetic and operative technique should have been completed before he is allowed to continue into the third and fourth year, and by this method the student will be better fitted to learn and practice orthodontia and dentistry.

New York College of Dentistry Orthodontic Course.

The plan which has been approved by the faculty of the New York College of Dentistry for the course of orthodontia is as follows:

Third Year Work.

Thirty hours of lectures in the third year.

Thirty-six hours of laboratory work, which is more than twice the amount demanded by the Regents.

The laboratory work is as follows:

One. Impression taking and making of orthodontic study models.

Two. The construction and application of two Angle expansion arches, using Dr. Mershon's method of band construction and adaptation, and cementing same to models.

Three. Construction of Mershon lingual removable arch, on upper and lower.

Four. Construction of Ainsworth arch with bands on molars and bicuspids.

Five. Construction of Angle pin and tube appliance, with Young-Angle latch lock on upper. Lingual arch with fingers, as advocated by Dr. Lourie on the lower.

The lecture course for the third year consists of thirty lectures, one hour each week, for a period of thirty weeks, upon the following topics:

One. Preliminary outline of the subject of orthodontia.

Two. The literature of orthodontia.

Three. First principles. (Scope.)

Four. History.

Five. Nomenclature.

Six—Development of dental arches.

Seven. Normal occlusion and the forces which govern the same.

Eight. Distinction between occlusion and articulation.

Nine. The transition from the deciduous to the permanent denture.

Ten. Malocclusion of teeth.

Eleven. Mal-relation of arches.

Twelve. Classification according to Angle and Lischer terminology.

Thirteen. The attachment of the teeth.

Fourteen. Tissue changes caused by mechanical stimulus, or tooth movement.

Fifteen. Harmony and face form.

Sixteen. General outline of anonalies.

Seventeen. Etiology.

Eighteen. The alveolus and peridental membrane, from an orthodontic viewpoint.

Nineteen. Impressions, models and plaster technique.

Twenty. Duplicating orthodontic models.

Twenty-one. Photographs and records; their value and uses.

Twenty-two. Uses of X-ray in orthodontia.

Twenty-three. Soldering and band technique.

Senior Year Work.

Fifty-four hours of practical work in the clinic upon patients.

Three hours (nine to twelve), one day each week, for a period of eighteen weeks.

This is absolutely imperative, and no man will be graduated who fails to live up to these requirements.

The lecture course for the fourth year is as follows:

One. Preparation of the mouth for orthodontic treatment.

Two. Records of treatment.

Three. Diagnosis.

Four. Arch predetermination. Hawley, Stanton, Hanau and Sved.

Five. Dento-facial deformities.

Six. Prognosis of oral deformities.

Seven. Anchorage.

Eight. The evolution in methods of treatment.

Nine. Dynamics.

Ten. Application and construction of fixed appliances, of all types, for orthodontic purposes.

Eleven. Treatment of mal-position.

Twelve. Treatment of simple neutroclusion. Class I. Angle.

Thirteen. Treatment of complex neutroclusion. Class I. Angle.

Fourteen. Treatment of simple distoclusion. Class II. Angle.

Fifteen. Treatment of complex distoclusion. Class II. Angle.

Sixteen. Treatment of mesioclusion. Class III. Angle.

Seventeen. Treatment of unilateral mesio-distoclusion. Class IV. Pullen.

Eighteen. The surgical treatment of extreme jaw malformations.

Nineteen. Retention of all kinds.

Twenty. The problem of extraction, or the "compromise treatment."

Twenty-one. Jackson and other removable appliances.

Twenty-two. Care of the mouth during orthodontic treatment.

This course was not formulated to educate specialists, but to give the undergraduate the necessary groundwork for his after-study and development; for no college can expect to turn out a finished product. It is time and experience, which are the parents of such a child, but the graduate dentist must know enough about orthodontia to recognize malocclusion in its incipiency and to be able to properly advise parents what course they should pursue, and save the child the necessity of prolonged treatment by early and skillful diagnosis.

Discussion of Dr. Waldron's Paper.

Dr. F. M. Casto, Cleveland, Ohio.

This subject I think is most opportune. At the present time there is a great revolution taking place in dental and medical education. You probably all know that there has been established in the Surgeon-General's Office of the War Department a dental and medical educational department. It is the purpose of this department to standardize dental and medical education. They have the opportunity to do this, because they have practically direct control of these institutions. It probably would not be possible to bring about the tremendous changes in the curricula and in the requirements of these educational institutions under any other conditions than those that are existing to-day. The War Department is now working in co-operation with the Dental Educational Council of America, and has established a classification of schools. They have placed dental and medical schools in Classes A, B and C. Class A schools meet certain requirements; Class B schools may be able to meet the first requirements, and Class C schools are schools that cannot meet with the requirements of Class A or Class B schools without reorganization. They do not recognize Class C schools. Therefore, all students in Class C schools in the draft age will not be allowed to remain.

In regard to orthodontia, there is a requirement in the Class A school for teaching a certain amount of orthodontia. You will all agree I think that the proper teaching of orthodontia is fundamental to the welfare of the future dentist, and especially to the welfare of the future progress of orthodontia, because the men who are to succeed the present quota in orthodontia are those who are going through the dental schools.

Another reason why it should be properly taught, is that with practically all State Boards throughout the country orthodontia is made a requirement just the same as is any other of the branches. I might say for your information in regard to the requirements in a Class A school that the number of hours that are required now are approximately 4,500 hours of teaching to the students in the four year course. That means about an average of 1,100 hours a year.

In regard to the work which Dr. Waldron has outlined and scheduled in his school, I wish to commend it. I concur in what he has said and the manner in which he is teaching. The work I have been doing personally has not been up to the present time conformable to all the work that he has laid out. It has been impossible, but I expect next year, and as soon as we are on a complete four year course, to install practically the same amount of teaching that he is giving. .

One of the greatest difficulties I have found in the real teaching of orthodontia is the clinical proposition. You all realize that in a dental school it is naturally difficult. The reasons are obvious, but we have attempted and will attempt further next year to have a certain number of practical cases that may be handled partially at least by the students themselves. We have installed for the coming year a man who will take charge of the orthodontic and periodontic department, and we think we will be able to get better results than we have heretofore.

Dr. John V. Mershon, Philadelphia, Pa.

I am very sorry that I am to discuss Dr. Waldron's paper. It is very difficult to talk on a subject that one knows so little about. I have occupied a teaching position for the last two years. Before then I thought I knew more about teaching than I do to-day.

The teachers of orthodontia in the undergraduate schools are between two fires. On one hand you have—as the essayist has outlined—a fixed requirement which is laid down by the various states. On the other hand, you have another condition; some State Boards are asking questions ranging all the way from jack-screws to "Are you still voting for Andrew Jackson?" (Laughter.) After you have employed enough time to meet all these requirements you can then start to do the teaching. I do not blame State Boards; in fact, I have the greatest of sympathy for them; they have a very difficult task. If in a meeting such as we are having at this session, discussing various subjects as we have, with the differences of opinion, we hear the men who are specializing in this department, differing quite radically from one another, how can we expect men on State Boards to agree? How can you lay down fixed rules for a progressive science in which our ideas next year will be different from what they are to-day?

As for the clinical side of the course in the undergradute schools, I question very much its value as a teaching method. The treatment of a case of orthodontia covers anywhere from four to six years, sometimes the life of a patient. The student will have a patient probably through one session, or part of two sessions, seeing the patients a little while through the Winter season until May, when they must discontinue their cases because they are studying for examinations. These cases are left till the following October or November without any attention, unless the school is carried over in the Summer and has a corps of assistants to care for these cases; and this does not teach the student. In some of the large schools, such as Dr. Waldron takes care of in New York city, where they have enormous clinics, this is a difficult problem, to say nothing of the injustice to the children coming to these clinics under these conditions.

How can we as teachers in a school where the men have to absorb operative dentistry, root canal work, and everything else pertaining to the whole curriculum in the dental schools, expect the students to become proficient in the practice of orthodontia with their limited opportunity? Practice can only be acquired through long experience, and I think it is a waste of time to undertake to teach the practice of orthodontia in an undergraduate school. I think the most of our time and energy should be devoted to the teaching of principles and the etiology of malocclusion and the possibilities of failure, and it should be taught as a department of biology and pathology. (Applause.)

Dr. B. E. Lischer, St. Louis, Mo.

In addition to a feeling of reserve on educational matters, I have had no opportunity to read the paper, and hence can only express myself very briefly on the subject of dental education. I note that Dr. Waldron limits the title of his paper to "The Teaching of Orthodontia to Undergraduates," for which I am deeply grateful.

This entire discussion, it seems to me, might be very logically divided into the immediate and ultimate. By immediate, I mean the present provisions in orthodontic education; and by ultimate, its final status.

It is an established fact, and it is becoming very widely known, that oral deformities are of very common occurrence. Fully fifty per cent. of the children of every community are undoubtedly affected by them. The number of individuals that a practitioner of dentistry, or a specialist, for that matter, can adequately serve, is very limited; so much so, that no community at present is receiving the required orthodontic service which it needs. It is one of the duties of the profession to assist in providing this service in as efficient a manner as the circumstances will permit. Unfortunately, though society itself must provide, in part at least, the circumstances which make for thoroughness, it has not done so up to the present time. That undergraduates should receive instruction in the principles and methods of orthodontics, permits of no arguments. Whether the time usually allotted to the subject permits of anything more than a mere superficial acquaintance with its contents, is open to debate. I am yearly becoming more thoroughly convinced that the entire dental educational system of to-day is inconsistent. Dentistry, including orthodontics, is a department of medicine and surgery. The advances of science have demonstrated this finally. The dental curriculum must therefore be recast to be in harmony with the best science of to-day. In other words, stomatology should be taught thoroughly in every medical institution. To do this, it will probably be necessary to reform the entire medical curriculum also. This must be the ultimate goal of all our efforts in educational matters. Any change of plan that does not keep in view the supreme end is a temporary compromise. Most dental educational reforms have thus far ignored this fact.

Dr. M. N. Federspiel, Milwaukee, Wis.

I have come to believe that the entire teaching curriculum in dentistry is wrong, and I believe it would be a good thing if we closed the doors of every dental school in the United States and asked the dental profession to rap at the doors of the medical colleges and ask for admittance. Think of it: to-day in our profession we are trying to teach a smattering of medicine, and we still try to be allied to or associated with medicine.

I believe the time will come when we will do less dentistry, but better dentistry. Ill-fitting crowns and bridges put in the mouths of patients to-day harbor pathogenic germs, and are contributory factors in producing more disease for doctors to treat. We are opening paths and are feeders of the medical profession. That seems to be a strong statement.

Orthodontic Clinic Opposed.

I do not think it is fair to let any dental student treat any orthodontic case at any time while he is a student of the school. I could not consistently ask a dental student in my Oral Surgery work to do a cleft palate operation; to do a resection of the jaw, or to remove carcinomatous tissue. He is trained to know that medicine is nothing more than applied biology. He is trained to know that he must be able to make a diagnosis and a differential diagnosis. He is trained to know what biology is, and what it means, and he is trained to know that treatment completes diagnosis and prognosis. Treatment is not complete until he knows something about diagnosis and prognosis.

After this great war is over, the average man who entered the Army Dental Reserve Corps will be an oral surgeon. That is a natural sequence. All one has to do is to take a knife in hand, draw a little blood, and he is an oral surgeon. (Laughter.) He buys a few curettes, wears a white gown, may have his operating room carpeted, and pretty shades on his windows; he may look the part of a doctor; he may make an incision in the gum; curette, scrape and poke around with gauze; but when you ask him to note the tissue changes that have taken place in the healing of wounds, he is lost. He cannot tell the abnormal from the normal tissue when he uses the knife. He is not trained in etiology; he has not been trained in histo-pathology.

Group Diagnosis.

The time is coming when we are going to have more group diagnoses; the one-man diagnosis will pass out of existence. You cannot go to work and become so proficient and finally practice orthodontia as a specialist without getting the aid of others in certain cases. We must have group diagnosis, and that is the ultimate goal of the art of medicine. So I believe that orthodontia cannot be practiced as successfully unless you have the co-operation of men around you. When, as Dr. Mershon says, a patient has to be treated for six or ten years, there must be something wrong. I do not like this perpetual treatment of patients. In my estimation, the ultimate goal of the science of dentistry will be a part of medicine; that every man must have the same entrance requirements that the physician has, namely, a Bachelor of Science degree. Dentistry will then become a specialty of medicine the same as opthalmology, rhinology, surgery, or genito-urinary diseases, and so on.

Dr. William C. Fisher, New York City.

My remarks before this society are not to be considered purely from the standpoint of a student, yet I am still a student. I am not a teacher of orthodontia, but as a student of orthodontia I have naturally followed the teaching of orthodontia, and I think there are one or two points that have not been touched in any discussion, not only here to-day, but in the past nine or ten years, in this society.

As a guest of the society, I will try to tell you one of your shortcomings. I do not think you men have measured up to your responsibility in the teaching of orthodontia. When I took up orthodontia ten years ago, I could not find what I considered (and that is no reflection on the Angle or the Dewey course), a high grade post-graduate course in orthodontia in America; and in desperation I turned to you gentlemen and your annual meetings, and this has been my post-graduate course; and I hope to make it a never ending one.

Orthodontic Educationl al Council Recommended.

But it does seem to me in the ten years I have been so cordially associated with you, that this society should have established, not a Committee on Nomenclature, although you established a good one, and this was done only recently; not a committee to consider this or that educational subject; but a Council on Education along orthodontic lines. You have the men in your society; they have the brains. There are no men on the Council of Dental Education of the National Dental Association that are your superiors, and few of them your equals. There are none in the Council on Education of the American Medical Association that are your superiors. When you consider that the American Medical Association has continued a man like Arthur Dean Bevan of Chicago as the head of their educational council year after year until he was made president of the association, you must realize that they have accomplished something. They have standardized teaching. It seems to me, a body of men like you could organize a Council and, if necessary, work in conjunction with the council of the National Dental Association. They would welcome your assistance in this specialty. If such a Council were formed and the results of their work made known, I am sure the Boards of Education and the State Dental Boards of the various states would gladly welcome your suggestions and criticisms.

I have wondered if a copy of the nomenclature you adopted last year has been sent to all of the members of the Dental Educational Councils of the forty-eight States. Has it? I mean State Boards of Dental Examiners.

Dr. Casto. It has been published.

Dr. Fisher. You have a wonderful work, and you men not only will measure up to it, but out of that will accrue what you absolutely need in this country, namely, not one post-graduate school, but post-graduate schools that are standardized and receive the approval of this body of men. I thank you.

Dr. Allen H. Suggett. San Francisco, Cal. There is another phase to this question which we have to consider, in enlarging our curriculum and in making it more intensive and extensive. It is along the line of what we were talking about last night in democratizing dentistry. We need better education, longer and better training; but we are all more or less handicapped by the conditions under which we are working now, in different universities. The academic courses are all free, but there is a fee exacted in the medical and dental departments. The fees are large; they are large for the average dental student who is taking a three or four year course as it is now. Some colleges require a junior certificate even before they can enter. This makes six years of college work. We are going as fast as we can in that direction when we consider how far the state has gone in tax supported help to the student. If we raise the standard so high, and make the curriculum so long, that it will work a hardship to those who have not the financial means, then we should either cut down these courses, or extend state help; otherwise we are working against the democracy we have been talking about and trying to put into practice to-day. We will have to work up the other end of the line and better our education of the people under tax support. No matter how poor the boy is, he should be given an opportunity to go ahead. He should be given the privilege to go through the high school, enter the university, and receive the six or eight years of training, which is necessary for him to take. The more help we can render along that line the freer each one will be to take up the thing he can do best.

Dr. Federspiel spoke of the Marquette University reducing the number of students from three hundred to forty. That is a good thing in one way, but it is a sad reflection on the state in another way. There are many of those men, perhaps the ablest of them, who were financially unable to take this course and had to drop out; but others on account of financial ability kept on. While you may have high grade students to-day, that does not mean you have not cut out superior men on account of financial reasons. While we are getting education and a better course of training, which I believe we all advocate and indorse, let us not lose the social point of view.

Dr. G. W. Grieve, Toronto, Canada.

I have felt for a long time that this organization should do something along the lines clearly outlined by Dr. Waldron, or there should be a Council which will gradually produce something we could work on. It is the dream of all of us, and we will have to come to it gradually step by step, and be entirely familiar with it. We should do all we can to advance the science of orthodontia, so that the next generation may have the privilege of living in a period when many of these things we do not enjoy now will be possible.

With the present facilities, and the length of courses in the dental schools, we should strive to establish some kind of minimum course in orthodontia for men taking the general course in dentistry, which would be much below that required by the men who are specializing. I think this should be undertaken by means of a Council such as that suggested by Dr. Fisher. Let such a Council establish a course which may be more or less adequately taught and absorbed by the students in dentistry.

If I understand the essayist correctly, he outlined a course which takes into consideration the technique of the work of making and working on models, even using Dr. Angle's pin and tube appliance, and all that sort of thing; the removable lingual or labial arch of Dr. Lourie's, with the finger springs, and all that we are seeing and using as specialists.

I think that it is a mistake to teach such things, for those of us who have taught in dental schools know it is a hopeless task, and the men who are going out into general practice, many of them going into country districts, cannot refer their cases to specialists, and these men ought to have some knowledge of the subject. There is an old saying that a little knowledge is a dangerous thing. If we could formulate a course and dictate to the Dental Boards and the Faculties of Dental Colleges how far the course should go, I think then we will be accomplishing much. The great difficulty I find is to be able to know where to draw the line. It may be possible to draw the line somewhere where these men in general practice may be able to take hold of patients presenting simple conditions, and thereby prevent many of the more difficult and intricate malocclusions. It seems to me, we want to work along these lines; and I agree with Dr. Fisher that this society or its members have not done their full duty. Many of the members of State Boards and of Faculties of Dental Colleges have not the knowledge that men of many years' experience in orthodontia have, and yet they are expecting men to do things which are absolutely impossible. Why not tell them it is impossible; that we cannot do it, and it cannot be done.

Let us have a Council appointed composed of men with long experience, who can give this matter serious thought, get together a number of times and discuss it thoroughly. It may take several years before they can come to anything in the way of a definite conclusion or idea, but let us try to get something to work upon.

The Text-Book Problem.

Another great difficulty is the fact that we cannot recommend a text-book on orthodontia in a dental school. There is no one book that covers the requirements. A text-book might be formulated within the course especially adapted to these students. They would like to see pictures of cases that have been treated by the skilled orthodontist, but do not lead them to believe in the possibility of doing that as well as a skilled specialist, as soon as they discontinue the general practice altogether and make orthodontia a specialty.

Dr. U. B. Shantz, Kitchener, Canada.

I have never been a teacher in a dental college, nor a specialist in orthodontia, although the subject has appealed to me as being of much interest. I have gone through one or two colleges, and I am at this time confronted with the idea that some time in the future I will contribute a student to one of the dental colleges, provided my only child shows any degree of fitness for it, and the question arises, since I have got rid of focal infection and rheumatism, and other things, will it be general practice or will it be a specialty? Root canal treatment, the specialty of orthodontia, or what will it be? And the question has arisen in my mind, if it shall be orthodontia that my child shall take up, why should he spend the bulk of his time on crown and bridge work, on operative dentistry or plate work?

I have been in Dr. Grieve's office. He has not enough equipment in his office to make a plate or insert a filling, because he is now doing orthodontic work exclusively. The last time I was in his office I saw a young man who graduated this year in dentistry. He has learned to put in gold fillings, but I am told here he has not been able to learn orthodontia in so short a time. Now, would it not be better to have a selected course for such a man, and get him into a place where he can do orthodontic work early in the course, even if it compels him to stay in for twelve months in the year? Most of these chaps would rather live in the city than in the country, and let them spend three years on a course if they are going to practice orthodontia, and give them as little general dentistry as they need, to know orthodontia. In other words, to parallel if possible the thing that happened sixty or seventy-five years ago perhaps, when the dental profession was founded out of a part of the medical profession, and at this time the profession of orthodontia might have a separate college or separate course, gaining only sufficient knowledge of general dentistry as the practitioner may need, the same as we today are gaining only sufficient knowledge of general medicine as we may need; not as much as we would like to have, but as much as we absolutely ought to have. This question appeals to me, and I wonder whether that will be a solution or not. I do not know. I wish I did.

If the idea I have advanced will furnish food for thought to some of you who may be on the Council to be organized, I am glad that I have contributed it, because it is a phase of the subject that was not mentioned in the discussion.

Dr. F. M. Casto, Cleveland, Ohio.

There was one matter mentioned which I think is of very great importance; and it has been suggested that we might have closer association between the American Educational Council and a Council from this Association, or any other association of dental colleges and state boards. The dental colleges, as I said a few moments ago, are under the supervision of the War Department at the present time; therefore the requirements have to be lived up to. Standards are being established all over the country so that a dental student admitted in New York or California, or in the north or in the south, will have practically the same education. No standardization has ever been made of state boards.

The standard of a state board is the standard of each state or the standard of each board. The government at the present time has no supervision over the state boards of dental examiners, so that there is no co-ordination between dental teaching and state board examinations in many of the states. There is no co-ordination between the teaching in dental colleges and state board examinations in many states, and if anything can be done to bring about closer co-operation between these organizations it would only be fair to the man who is to put in his time in studying dentistry.

Dr. Burt Abell, Toledo, Ohio. Why would it not be a good idea for this board of control of the government to send out the examinations, in order that that may be taken out of the hands of the state boards?

Dr. Casto. It cannot be done now on account of the state laws.

Dr. Fisher. This regulation that Dr. Casto refers to will end with the war. The only thing we can hope for in this respect is to form some sort of organization, such as a national organization of your dental examining boards, just as some of the colleges have throughout the country. I mean a real one.

Dr. Casto. We must have standardization throughout the country, so that there will be co-ordination between the two.

Dr. Allen H. Suggett. A State Board of Examiners is superfluous. I believe it is only a matter of time when the government will control the different colleges, so that when a man graduates from any college he can practice in any state. At the present time, some of the states have a higher standard than others, hence it is more difficult to pass the State Boards in some States than it is in others; but I believe in the course of time this will be eliminated or rectified.

Dr. Waldron. I am pleased that my paper has brought out such a free discussion; for that is why the paper was written, in order that we may standardize the teaching of orthodontia in our colleges; but I am sorry no suggestions have been offered wherein some beneficial changes may be made.

It has been pointed out by Dr. Mershon that we have to prepare students for the State Board examination, as well as to give them a dental education, and he has truly remarked that many of the questions asked by members of these boards are very ancient. Therefore we must instruct students in these antiquities in order that they may give satisfactory answers to men whose ambition it is to be members of these State Boards, regardless of their qualifications.

Luckily for all concerned, these men are in the small minority, and I hope the day is not far distant when there will be a standardization of State Boards as well as of dental colleges.

I think that Dr. Grieve has not understood that part of my paper regarding the technique work in the Junior year. We have devised a manikin head at the New York College of Dentistry, and the student is obliged to construct the technique work upon models in the manikin head, which I think is about the nearest thing to working on the living subject.

This is merely the construction of appliances and their application on technique models, in order to prepare the student, that he may be more able to work on the human being in his senior year.

It would be a mistake to give a student material and allow him to work upon a patient before he has had practice upon some inanimate object.

The idea of this technique work is not to impress upon the student that we recommend these kind of appliances, but that he may have a variety of technique work, in order to better fit him for the construction of such appliances, as are to be used on living subjects in the senior year and later in his own practice.

A Consideration of Some Principles of Regulating Appliances.

By MARTIN DEWEY, Chicago, Ill.

Regulating appliances may be defined as mechanical devices for exerting pressure upon malposed teeth, for the purpose of creating cell activity and thereby causing the teeth to assume proper positions in the line of occlusion. According to this definition, regulating appliances must be considered from two sources; namely, as mechanical devices that produce pressure on the malposed tooth, and this pressure does two things. First, it produces cell activity and then in conjunction with the cell activity, it moves the tooth into the proper position that it should occupy. A careful analysis of this definition will result in an understanding of regulating appliances, which has not been observed in the past by a large number of manufacturers and men advocating the use of two different styles of appliances. In times past, regulating appliances have been used and advocated which considered only one part of this definition, namely, the exerting of pressure upon malposed teeth for the purpose of moving them to a certain position. Any regulating appliance that has for its object, the mechanical movement of a tooth without a consideration of cell activity will produce a pathological movement and result in all sorts and various kinds of undesirable conditions.

Any regulating appliance for the correction of malocclusion should be an aid toward Nature's process of development and should aim to produce pressure on the tooth and create cell activity, and from that time on the movement of the tooth should be as near in keeping with the development which occurs during development and tooth eruption as can possibly be obtained. In times past the various requirements of regulating appliances have been enumerated, and in Angle's Sixth Edition we find the following: "Efficiency, simplicity, delicacy, inconspicuousness and stability of attachment."

Efficiency of Regulating Appliances.

Admitting that these five requirements are essential, there is no question but that efficiency takes foremost rank among the requirements of regulating appliances. Regardless of how nicely an appliance may be constructed, or how beautifully it may work on paper, or how successful you may be in obtaining a patent from the Patent Office to cover this appliance, if it is not efficient it necessarily will be a decided failure. We recognize the fact that almost any style of appliance which exerts pressure on a malposed tooth will produce some sort of a result. Consequently, men in using appliances which fall far short of the best orthodontic principles have been able to accomplish results, but the appliance has been very lacking in efficiency from a physiological and mechanical standpoint. In explaining efficiency of regulating appliances, we may say that you are able to travel over the country in a large automobile freight truck and you would eventually complete your journey, but you would be able to travel much more rapidly and with much more comfort in a touring car, and for that purpose the touring car would be considered more efficient for traveling. The automobile truck might have an efficiency for another purpose but not as a pleasure car.

Stability of Anchorage.

Related to efficiency, which is foremost among the requirements of regulating appliances, we cannot help but believe that the stability of attachment or anchorage plays a great part and is a certain factor in efficiency. An appliance may be very nicely constructed and may possess wonderful mechanical principles, but if we do not have stability of attachment either to the anchor tooth or the malposed tooth, we necessarily are going to get an unsatisfactory result.

In considering the question of the principles of appliances, we may define anchorage as a resistance to overcome an applied force. We must also remember that action and reaction are equal, and consequently our anchorage must be sufficient to absorb the force that is going to be applied to the malposed tooth, unless we use reciprocal anchorage, in which case the action and reaction are both equalized by selecting a malposed tooth as the point of resistance. We believe that anchorage is one of the more important factors in the efficiency of regulating appliances, and is something which should be considered separately and distinctly from the regulating appliance during the planning of the treatment. One of the first things to be considered is your point of resistance, and an ideal appliance is one which is so constructed that you pay special attention to resistance and increase that resistance by mechanical principles and plans.

In a great many instances it will be desired to construct your appliance so as to stabilize your anchorage and in reality have a portion of your appliance concerned in anchorage separate and distinct from the moving part.

Several years ago Dr. Barnes, of Cleveland, called attention to the fact that in using the labial alignment wire, commonly known as the expansion arch, there is a great tendency to displace the molars distally and buccally. It seems to me, that the majority of orthodontists practicing at that time did not pay enough attention to Dr. Barnes's contention, for a large number of results show that men were moving molars distally and buccally by displacing their anchorage. The reason for this is that the natural tendency of the labial alignment wire when used to expand the arch and at the same time to move the incisors forward is to exert a distal and buccal force on the anchor tooth. By using the ordinary molar clamp band or single attachment upon the molars, there is no provision made to prevent this distal and buccal movement except the supporting tissue.

Now, as an example, the efficiency of such an appliance can be greatly increased and the anchorage stabilized if the molar on the right and left sides were attached to a lingual arch, which lingual wire would not be used to move the molars, but would be relied upon for stabilizing the molar anchorage. Also, this lingual wire could be so constructed and used as to produce the molar expansion, and the expansion of the molar would be under the influence of the lingual wire, and in no way be affected or influenced by the labial alignment wire, which is producing the movement of the rest of the malposed teeth. As a result of this, we believe that one good principle of regulating appliances is to have a separate and distinct attachment upon the anchor teeth, whereby you can control them independently of the rest of the malposed teeth.

Individual Tooth Movement.

We may further say that any regulating appliance will be increased in efficiency, as it is constructed so as to allow individual tooth movement or individual adjustment. In the last few years attempts have been made by certain men to introduce appliances which could be adjusted at one time and which would move the teeth to the proper position without further adjustment. Appliances have also been introduced which have been made out of small gauge wires for the purpose of exerting pressure upon all the teeth at the same time and moving all of them into the line of occlusion. We recognize the desirability of moving all of the teeth at once, but we also are forced to recognize the mechanical principle that with a bent, curved or looped wire, fitting into brackets or attached in tubes, it becomes practically impossible to exert force on one malposed tooth without changing the relation to the approximating tooth.

As a principle in the construction of regulating appliances I would therefore say that an appliance should be so constructed, that each individual tooth can be adjusted without destroying or changing the force on the approximating tooth. This factor is one thing which has made the use of the alignment wire with ligatures such a universal appliance. If we had a sixteen-gauge wire with properly constructed anchorage ligatures, by tightening one ligature on the alignment wire we would not disturb the approximating teeth, provided the alignment wire is heavy enough to absorb the force from the tightened ligature.

In other words, an appliance should be so constructed as to have firm anchorage. Then there should be a base wire or part to that appliance from which the force to the individual teeth is obtained. As an example of this, one of the beautiful mechanical principles of the Jackson removable appliance is the construction of the appliance in such a manner that groups of teeth serve as anchor teeth, thereby greatly increasing the resistance over single teeth. Secondly, the appliance consists of a base wire from which the various forces are originated. These various forces are produced by means of individual finger springs which work on individual teeth and on such teeth as need to move in a certain particular direction. In adjusting these appliances to exert increased force, the finger springs can be adjusted to exert pressure on a single tooth or group of teeth, and without disturbing the base wire. Therefore, no undue stress has been brought to bear on the anchor teeth as the result of changing the entire appliance; neither has one group of teeth been disturbed by adjusting or increasing the pressure of another single tooth.

Essentials in Appliance Construction.

We would therefore say that as a general rule regulating appliances should possess three distinct mechanical parts or plans: First, some means of procuring the anchorage, then having that anchorage under absolute control. Secondly, the construction of a base wire from which the force is exerted; and, thirdly, some sort of attachment to that base wire to exert the pressure on the malposed teeth. Those are three things which must be considered, and if it is possible to obtain those three things in a simply constructed appliance, so much the better. But if the malocclusion is very extreme it will be necessary to greatly change the appliance from what has been used in times past in order to follow out those principles.

It is possible to follow out those principles with a removable regulating appliance and the same thing can be obtained with fixed appliances. An example of fixed appliances which control the anchorage and which furnish a base from which the force is applied to the malposed teeth, and which furnish individual tooth attachment is such an appliance as was advocated by Dr. Lourie at our last meeting, namely, by using plain bands upon the molars and a lingual alignment wire soldered to those molar bands we are able to utilize that lingual wire for the purpose of controlling the molar anchorage, and also by proper manipulation can move those molars in various directions. Now this lingual wire will control the molars absolutely and should be utilized in a large number of cases for no other purpose. However, with the proper construction of the lingual alignment wire it will not only be possible to use wire to control the molars, but it will also be possible to make various tooth movements in the other parts of the mouth.

As a means of exerting pressure from the lingual alignment wire upon individual groups of teeth, the finger spring used by Dr. Mershon, is good. The use of the finger springs upon lingual alignment wires affords a means of exerting force upon malposed teeth by using the lingual wire as the base wire, which can also be used as a means of stabilizing the molars. In using the finger springs upon lingual wires, following out our mechanical principles, the finger springs should necessarily be of a smaller gauge than the alignment wire, so that the lingual alignment wire will be capable of absorbing all the force from the finger springs and not be distorted and therefore exert pressure on teeth when that pressure is not desired.

We have called attention to the fact that a principle of regulating appliances should be the stabilizing of the anchorage, and that the lingual alignment wire can be used to stabilize the molars and used for that purpose only. Then as a means of exerting pressure upon the malposed teeth, we would recommend the use of the labial alignment wire, and for reasons of inconspicuousness would say that the labial alignment wire should be placed high, or gingivally, out of sight, as shown by Dr. Lourie in his paper at Excelsior Springs. Now this labial alignment wire becomes the base wire from which force is exerted, and the force to the individual malposed teeth is again exerted by means of finger springs in whichever direction it is desired. In order that individual force can be exerted by means of finger springs upon individual teeth, the finger springs are made out of material, say twenty-four or twenty-six gauge, while the labial alignment wire is made out of material seventeen or eighteen gauge. This difference in gauge between the size of the labial alignment wire and the finger spring makes such an appliance that pressure can be brought to bear upon individual teeth and this pressure will be absorbed by the larger labial wire. The resistance of the labial wire will be obtained from the anchor teeth, which have been stabilized by means of a lingual alignment wire.

We believe in times past, appliances have been constructed in which too little attention has been paid to the anchorage. An appliance should be so constructed that pressure can be exerted on malposed teeth without disturbing or changing the anchor teeth. This can only be done when you have the anchor teeth stabilized, or have some means of absolutely controlling the teeth to which the attachment is made.

Another principle of appliances which I wish to mention is that no regulating appliance should be so constructed as to be universal for various cases. Advertisements have appeared in our Journal, articles have appeared as scientific papers, in which men have advocated the use of one style of appliance for every type of malocclusion. Advertisements have also stated that if this appliance is placed on the teeth it will do the work. Such claims are very misleading, and any appliance for which it is claimed that malocclusion can be corrected by a single adjustment is a very good appliance to leave alone. We must remember that a regulating appliance exerts pressure on malposed teeth for the purpose of creating cell activity, which, therefore, means that we are dealing with physiological tissue and this tissue will not respond in the same manner in different individuals, even though the malocclusions are of a similar type. Also, any regulating appliance which exerts enough pressure on a malposed tooth in the beginning of the case to carry this case to completion is a dangerous thing to use.

Another feature, or principle of appliances is that the appliance should exert force on the tooth so as to move the tooth physiologically. Any tooth which is being moved physiologically will be moved painlessly. As a result of this it becomes necessary that any appliance that exerts pressure on a tooth must do so without producing pain. Pain is absolutely unessential and unnecessary. It is to be avoided and can be avoided by the proper construction and use of the appliance so as to exert the proper degree of force. Pain is always an indication of faulty technique, which may be caused by improperly constructed bands, or the improper application of force, and any appliance which does not move teeth without pain is not moving them physiologically.

In closing, I will say that if you consider appliances from the standpoint of the definition and what they are to do, and remember that you have certain mechanical laws which must be observed, a large number of appliances will constantly be cast into the discard because they fail to conform to these mechanical principles.

Discussion of Dr. Dewey's Paper.

Dr. William G. Law,
New York City.

I have not very much to say, as the principles of appliances having been so clearly stated in Dr. Dewey's paper.

There are a few small points which to me are exceedingly important, which accompany the ideas presented concerning the underlying principles of regulating appliances, and while efficiency, of course, is the main thing to be considered in all work we undertake for our patients, efficiency is a very big word. Beauty lies in the beholder, and it has always seemed to me that the appliances which we should use should first be made as beautiful as possible and as inconspicuous as possible. It has been my experience that patients do not like the looks of any kind of appliances, and the first thing we should ask ourselves in selecting either a metal or alloy appliance is, "which is the least conspicuous?' The bands used on the anterior teeth should be of a form that lends beauty, and the appliance which covers that labial surface of the teeth, if one is used, should be made so close to the teeth and so small that it does not interfere with the movements of the cheeks and lips. Dr. Rogers has brought this out in his paper, showing the necessity of allowing the teeth and lips to have free movement. On the inside of the mouth this is quite true of the tongue, and the smaller the appliances, in my experience, and the closer it lies to the gingival margins, the more the tongue can have free movement and free function. The smaller the appliance used in every case, consistent with the strength of the wire, the nicer the result. Naturally we must think of wire that has a character, that will not lose its force in the action we undertake. We have to-day, wires which we can use in the small gauge, and for band material, which can be used in a thin gauge that answers every purpose much better than thick or large wires.

Cleanliness of
Appliances.

As to the question of cleanliness in the mouth, where an appliance is left in the mouth for a considerable length of time and you cannot see the patient very often, the appliance should be constructed in such a way that the patient can keep the teeth comparatively clean. Unless this is done, we have the chance of having disagreeable results, and what is the use of regulating teeth and putting the mouth and face in harmony if the teeth go to pieces under our appliance? So not only should the appliance be constructed from the standpoint of efficient work, but it should be beautiful and it should be cleanly. I believe all of these points can be brought into every appliance for every case that we treat, whether the patient is three or sixty-three years old! Older patients' teeth move apparently as easily as teeth do in younger patients. It takes a longer time to accomplish a great many of our movements. The teeth move. The muscles themselves move, if not counterbalanced by the muscles. Move the teeth in any direction and the muscles pull or press upon the teeth. That is shown in a great many cases where there has been loss of the tongue or loss of bony tissue of the part, or where abscesses have occurred, or injuries have occurred on the face in the neighborhood of the jaw; the muscles have contracted the bony structures and moved teeth with them all out of position.

Dr. Rogers shows how the muscles, through proper and normal functioning, develop the jaws and develop the face without the aid of any appliance; and others with the aid of small, gentle, coaxing appliances, with the aid of the muscles, and his results are, in proportion to what we knew some years ago, very gratifying.

We can do our work with smaller appliances, seeing the patients less often, and with less discomfort for these little patients than we ever thought before, and the principle underlying all appliances, underlying all efficiency, should be the absolute control of every tooth that the appliance touches, whether it be a molar, or whether it be a tooth to be moved aside from the molar.

I believe that the large bands which have been used to attach labial appliances to the molars by screws and tubes are disappearing, and that is to me a great advantage in cheek freedom. Even if we are compelled at times, as we are, and always will be, to use a labial arch of small gauge, we can use a small tube, one that lies close to the molar band and will not interfere with cheek movement, and will produce absolutely no discomfort to the patient. It will be nearly the same as though no labial appliance was present. The larger the labial appliance, the more discomfort the patient experiences, and the least appliances you are compelled to use, the more comfort the patient will have. I believe we will succeed in the future in controlling and correcting all of our malocclusions with lingual appliances, and then the ideal will nearly have been reached, and the amount of control in the corrective work that is necessary from labial appliances will be so small and the appliances will be so inconspicuous that there will be no disadvantage in using them, and they can be used often as a removable appliance which will not have to be worn

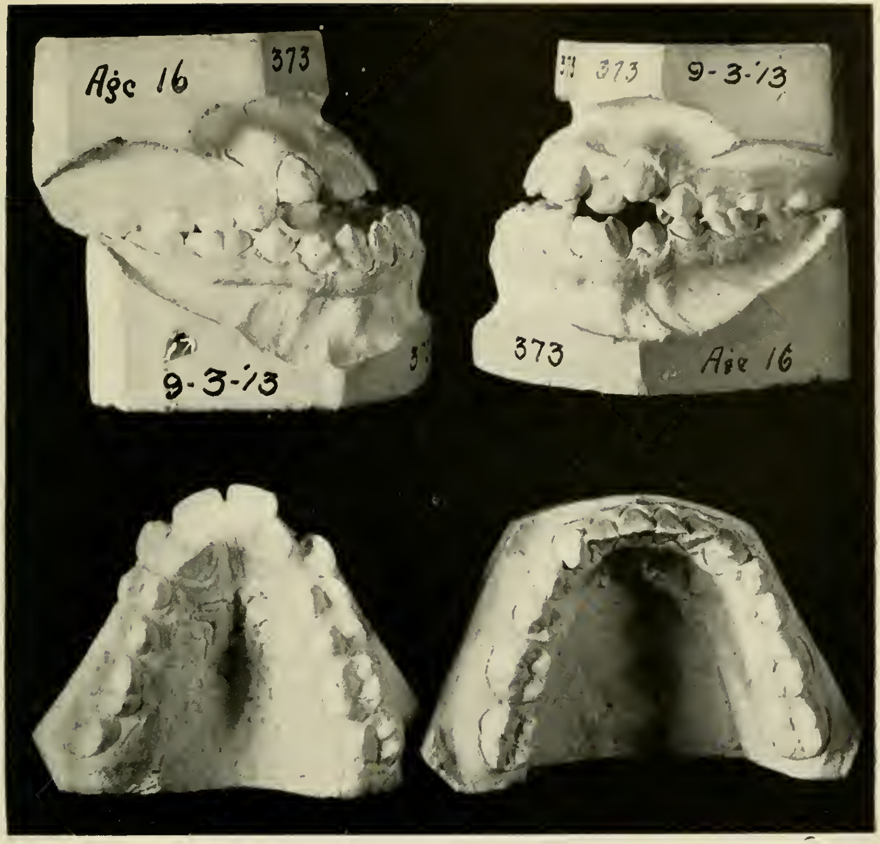

Fig. 1.

all the time but can be removed as we direct for cleanliness and also for esthetic appearances.

Dr. Ray D. Robinson, Los Angeles, Cal.

I have a case to show at this meeting, and I believe it would be quite apropros to put the slides on at this time in answer to Dr. Dewey's criticisms which were leveled at the appliance with which this case was corrected and which I showed the Society some years ago, and if I may have your permission, Mr. President, I will show the case at this time.

Dr. Dewey made some statements to which I must take exception He said that "if the force is sufficient to move a tooth the full distance which it must travel, it is too severe in the beginning." I grant that this may be true with the appliance or appliances he uses, but it is not so with the small appliances. It is possible to use an appliance made of

.020 wire which will move a tooth over a great distance without at any time exerting more than a fraction of an ounce of pressure. That is the basic principle of the little wire. It can be so adjusted that it will continue its slight pressure for a long time and over a long distance in space. I hope that point will be taken home. I hope you will understand exactly what I mean when I say that.

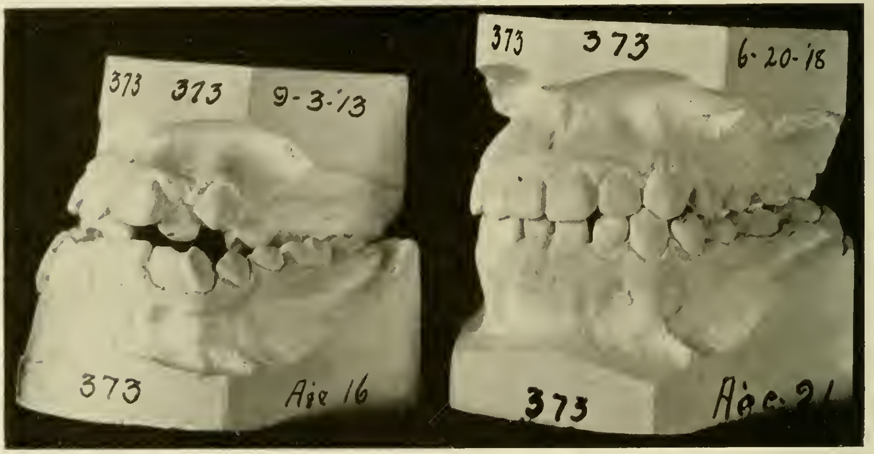

Fig. 2

Another statement to which I wish to take exception, was made by Dr. Dewey. His statement was: "that all types of cases cannot be handled with the same type of appliance." Maybe he cannot do it, but I attempt it at least. I have used nothing but the .020 wire for a number of years. Another thing I wish to say is this; that Dr. Dewey is quite unfair when he refers to the multiplicity of loops and twisting of the wire. Dr. Dewey is very well informed that such has not been the use of my appliance for more than two years. Dr. Dewey has been informed on that point for nearly that length of time. I will remind him that Dr. Sweet showed him some models with this appliance on, in Dr. Beaser's office, and he talked with Dr. Sweet for more than an hour and Dr. Sweet told him I had given up the loop and the appliance was put entirely inside. I also brought that out in the paper I read last year, yet Dr. Dewey in his book, which was published long after his talk with Dr. Sweet, speaks of the labial appliance with a multiplicity of loops. In fact, the part of his book having to do with my appliance is almost an exact reprint of a paper read and published in 1915.

In view of the fact that I have admitted before this body and before other societies, that the appliance shown at the Toronto meeting was faulty and that the anchorages were not as stable as could be desired, and in view of the fact that Dr. Dewey had full knowledge of these things it is unfair of him to come here and criticize that appliance as advocated four years ago, and to publish in his text book, as my appliance, a form of appliance which he knows is obsolete and has been abandoned.

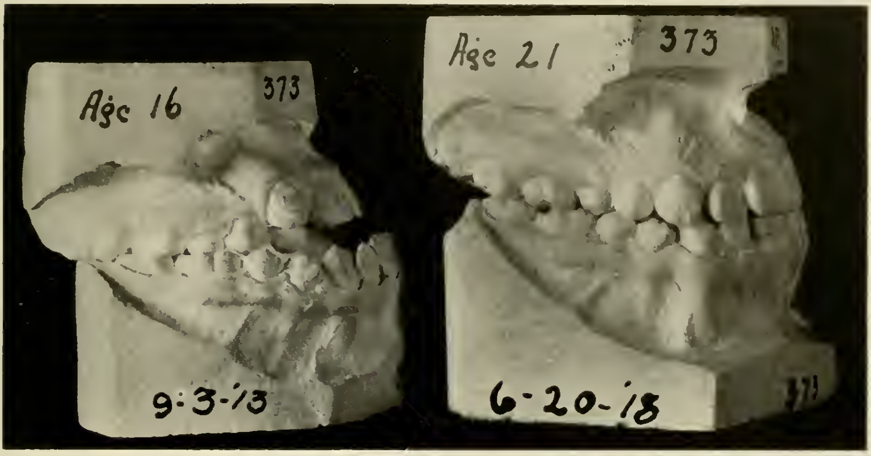

Fig. 3.

The case I wish to present in answer to Dr. Dewey is shown in Fig. 1.

Case History.

I believe that we all have cases come to our attention in which the amount of tooth movement necessary to establish normal occlusion is so great that we are in doubt as to the advisability of undertaking the correction. I must plead guilty to hesitancy in many cases, and this was one of that class. The amount of work necessary, the age of the patient, and the chances for successful issue were all unfavorable and I at first refused the case. The parents, however, were insistant and, as I was anxious to try the small wire on a case requiring radical tooth movement, I undertook the work. This was done, however, with a full understanding on the part of the patient and her parents that it was to be an experiment with a new type of appliance.

I think you will agree with me that in such a case as this there can be hope of but little posterior movement of the mandible, and that practically all of the movement must be an anterior movement of the maxillary teeth. If you will observe you will see that to accomplish such a movement it would be necessary to move the maxillary incisors and cuspids into a position where they would be entirely outside the alveolar process by as much as half an inch. Yet that is exactly what was undertaken.

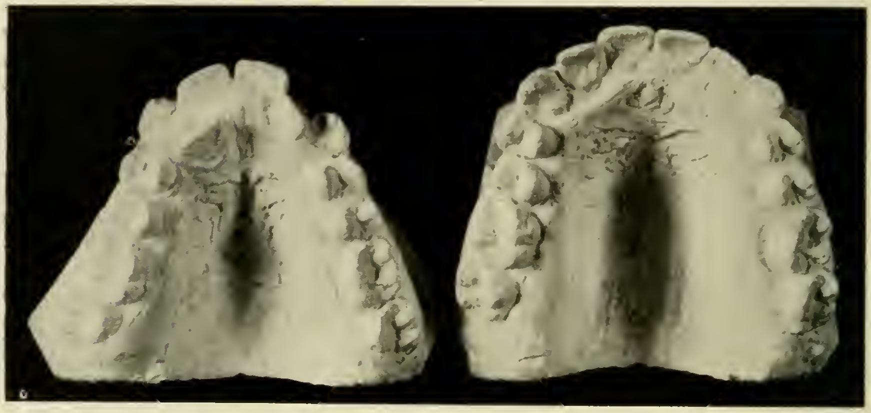

Fig. 4.

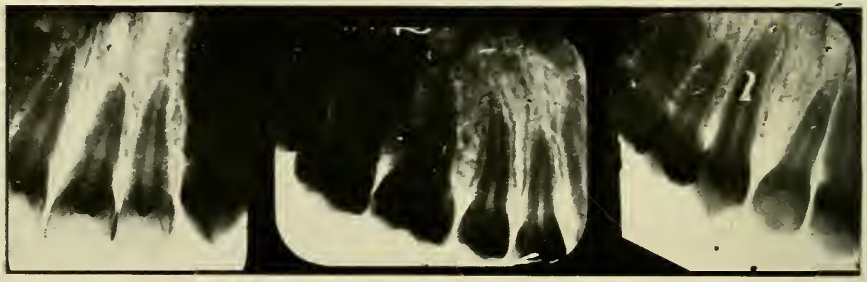

Fig. 5.

The lingual arch was adjusted in this upper and a full year was used to accomplish the required expansion. After this, bands were adjusted on the upper right cuspid and central and a short wire with a loop was placed between them to secure their separation for the accommodation of the lateral. After this space was wide enough, an arch was placed on the labial side of the cuspids and incisors in such a way that it would exert pressure labially on the apices of their roots and at the same time a loop was dropped lingually to engage the right lateral and exert pressure to bring it into its proper position. After it was nearly in such relative position intermaxillary rubbers were applied as in all cases of mesial occlusion and the correction was finally completed in a little more than four years after it was first undertaken. Figs, 2, 3 and 4 will show what was accomplished. The right maxillary lateral was moved more than three-fourths of an inch. All of the incisors and cuspids were moved into a position which at first was outside the line of the alveolar process, and an occlusion was established. Whether the occlusion is normal or not is for you to judge.

I feel that you are asking what the condition of the teeth is at present, whether they have any bony support, whether they are vital, and other similar questions, and you have the right to ask such questions. A look at Fig. 5, which was taken just before I left Los Angeles, will, I think, answer your questions. If not, I will say that the teeth are as firm as when I first saw the patient.

Now, gentlemen, if the .020 wire will do that, why use larger wire? It has done it and there are men here who have been in my office and who have seen the appliance in this mouth working. Your President is one of them. When the .020 wire does these things, I say why use the larger ones? I just want to leave that question with you.

Dr. Ralph Waldron. I would like to ask Dr. Robinson if any magazine has ever published an article with illustrations of this appliance he speaks of, which is applied on the lingual and not on the labial surfaces of the teeth? I follow the dental literature very closely and do not recall seeing such an article other than the paper he read before this Society at Excelsior Springs, Mo., last year, and that paper was not illustrated, nor was the technique described. It was a paper entitled, "Further Experience with the .020 Arch Wire." His paper was a plea for the use of lighter arches and was very timely, but in it he does not refer to a lingual arch, nor does the discussion of this paper include any such reference.

I assure you I supposed Dr. Robinson's work was all done with the arch he showed us at Toronto, except with modified seats and blocks, and less exaggerated loops, and I can imagine Dr. Dewey was of the same opinion as myself. Therefore, I think Dr. Robinson has been a little severe in his discussion of this paper, as far as his assertion that Dr. Dewey was unfair.

Dr. Robinson has shown us a most remarkable case, and deserves a great deal of credit, for he has obtained a most satisfactory result, but I would like to see the appliance and learn his technique, and I hope he will give us a paper in the near future showing his *modus operandi* more in detail than he has in this discussion.

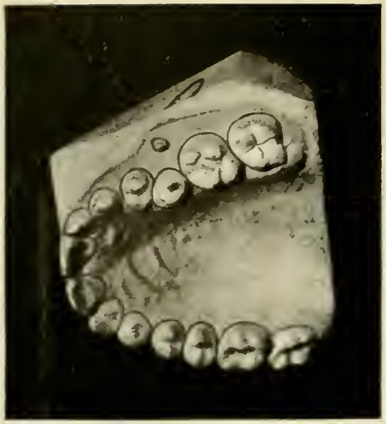

Fig. 1.

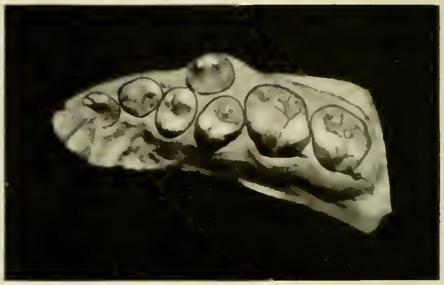

Fig. 2

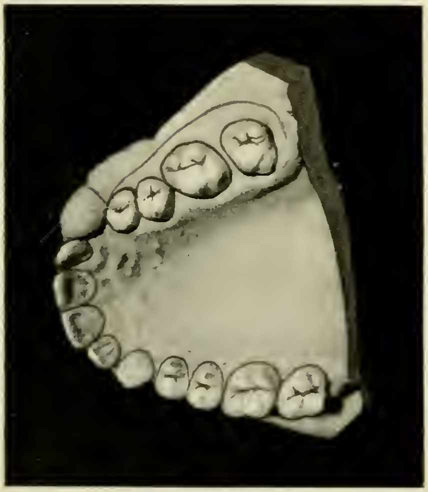

Fig. 3.

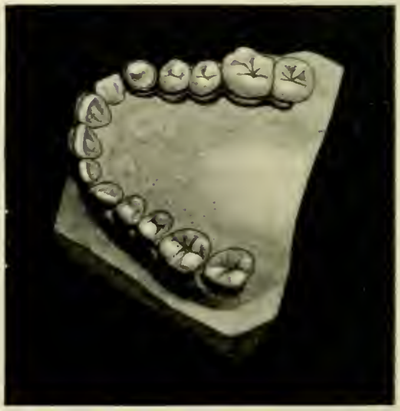

Fig. 4.

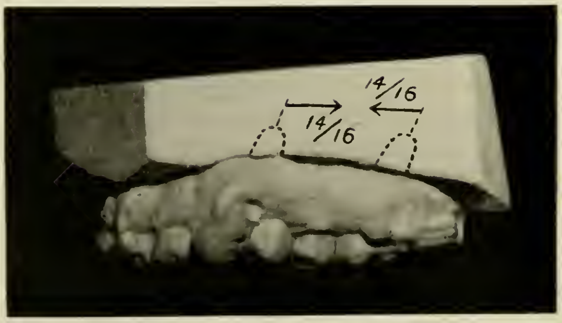

Fig. 5.

Dr. Robinson. That appliance is here on models, and I am down for a clinic and it will be shown at that time. It was described last year in my talk at the meeting held in Excelsior Springs.

Dr. F. G. Rodgers, St. Louis. During the course of treatment of orthodontic cases, teeth often need to be moved bodily to varying distances in order to bring them into normal occlusion. The question has often occurred to me, "How far can a tooth be moved without destroying the vitality of the pulp?" Recently, a case was presented to me for treatment which offered an opportunity to answer this question.

The patient was a young miss of fourteen, with all the permanent teeth erupted in normal occlusion except the upper left cuspid which was impacted over the buccal roots of the upper first molar and lying diagonally across these roots. The tip of the cuspid crown erupted just through the gum to the mesial of the buccal cusp of the molar and the apex of the cuspid was superimposed over the distal root of the molar. (Fig. 1.)

The problem presented for solution was, to move the cuspid bodily from this impacted location, past the two bicuspids into its normal position. The case was further complicated by the location of the tooth which made it impossible to attach an appliance. (See Fig. 1.) The survey made on the model shows the distance that the apex of the cuspid had to be moved. (See Fig. 5.)

Treatment. The first stage of the treatment was started with a Jackson removable appliance, consisting of a delicate spring wire curved up over the gum distal to the second molar and made to bring pressure mesially against the cuspid root at the junction of the crown. Active force for moving the tooth was obtained by repeatedly opening the loop of the spring wire until the tooth was in a position as shown in Fig. 2.

At this stage, the position of the tooth began to change from vertical to horizontal, as shown in Fig. 3, which necessitated the use of a different appliance. A band with a root-wise extension (Case) was adjusted and cemented on the crown. An alignment wire anchored on the molar teeth was used to hold the cuspid crown in position, while moving the root mesially by means of sea-grass ligatures, which were attached to the root extension on the band to a spur opposite the central on the alignment wire.

The stability of the tooth at this stage was in a precarious condition; it was held in place by a thin layer of gum tissue over the root; the apex was almost exposed, while the crown had to be supported and held in position by the alignment wire. The vitality of the pulp, up to this stage, was normal; it responded to thermal tests.

Figs. 4 and 5 show models of the case with the cuspid tooth in its normal position. Further treatment was suspended on account of the summer vacation and in order to give Nature a chance to stabilize the tooth by regeneration of peridental fibres and a deposition of the bone around the tooth.

A Member. What about the vitality of the pulp?

Dr. Rodgers. That I do not know. I have not been able to determine. I have made tests and I am inclined to think the pulp is alive. The gum tissue surrounding it gives me a false response. There has been no unusual pain experienced. I am anxious to know the condition of the pulp.

A Member. Did you try the Faradic current on it?

Dr. Rodgers. Not yet. I have not been able to contact the crown of the tooth with the Faradic current. I tried thermal shocks, but the response may be due to the natural soreness of the tooth or it may be due to the pulp. I am sorry I cannot give you a definite statement as to the condition of the pulp at the present time. I am anxious to know what became of the tissue in the blood-vessel in connection with moving the tooth so great a distance.

A Member. Is there bone over the labial surface of the cuspid now?

Dr. Rodgers. Nothing but gum tissue. If we let it alone for two or three months there may be regeneration, owing to the cementum and the conditions that are seemingly favorable.

Dr. Dewey (Closing). It seems to me, the gentleman from California (Dr. Robinson) misunderstood the title of my paper, which was "Some of the Principles of Regulating Appliances," and not "a consideration of appliances." However, owing to the fact that some of the members have been inclined to bring up the question of appliances to illustrate their remarks and say something with regard to the principles of these things, I will take this occasion to say a few words along that line myself.

I did not criticize the use of the small wire, the .022 or .020 wire, but if you remember I made a plea for stabilization of the anchorage; the construction of regulating appliances, separate and distinct from anchorages, and I made the further plea for individual tooth movement. The gentleman seemed to think that my remarks were a criticism of his appliance, where he used loops. It was no more a criticism of his appliance where he used loops, or where he did not use loops, than of any of the other appliances, whether it be a labial or lingual appliance. The question of loops in an appliance makes it impossible to have the direct application of force. Whenever you begin to open the loop in an appliance, just at that time your appliance may be out of alignment and you produce a change; you lose control, and even if you use careful measurements with calipers you are still uncertain as to how much force you are producing on the molars.

Now, I made a plea for individual tooth adjustment with finger springs, as was shown yesterday. The loop appliance was shown in one paper which I criticized just as much as in the appliances shown by the gentleman from California. With the tube and pin appliance, when you open the loop you change the adjustment over one tooth and also the approximating tooth. It is impossible to do otherwise. Then if you have a small alignment wire, labial or lingual, .022 or .020 of an inch, with no other provision to control the molar anchorage, the minute you exert force on the malposed tooth you change the force on the anchorage. The fact that you have to use an attachment on the anterior part of the alignment wire to keep it in position is a plain admission of the fact that the appliance is slipping around. Whenever you tie the lingual alignment wire to the anterior tooth to hold it in position, you are tipping the molar, your alignment wire is so flexible that it is slipping, and the minute is does that you lose the direction of the force that you gave the .020 alignment wire, lingual or labial. If you use it in accordance with the principle suggested and stabilize the molars, so that you can adjust the small gauge to the malposed teeth, you will not have reaction on the molars in the direction you do not want.

The gentleman from San Francisco, claimed that I advocated large alignment wire. I advocate alignment wire heavy enough to control molar anchorage, and I contend that you cannot control molar anchorage by the use of .020 alignment wire unless you use some measure for stabilizing anchorage. The minute you bend it into place it flexes out at some other point. If you stabilize the anchorage in some way and use a smaller wire, it is all right, but you must have the molar anchorage stabilized. The advantage of finger springs over loops in an appliance is when you attempt to straighten out the loops. It does not make any difference to me what style of loop of appliance you consider, it is a dangerous proposition unless you get force in a straight line.

Muscle Training and Its Relation to Orthodontia.*

By Alfred Paul Rogers, D.D.S., Boston, Mass.

Mr. President and Members of the American Society of Orthodontists:

It is often said that we, in our human experience, learn more from and accomplish more by the study of our failures than by the contemplation of our successes. More or less frequently there occur in the practice of each of us failures to maintain the results of our conscientious efforts. It is true that some of our failures are due to causes which are, at the present time, quite beyond our control. We have many types of children to deal with,—children of varying degrees of mentality, health and discipline. It is quite impossible with some children to obtain results where the elements contributive to failure are due to some mental defect, making our efforts for that particular individual quite useless. In contemplating certain types of failures in my own practice, I have been reminded that a closer study of those forces of occlusion which could be placed under our immediate control might form a basis upon which to secure more permanent and satisfactory results.

It is true that our teachers have been diligent in the past in calling our attention to the various natural forces that contribute to the establishment and maintenance of the occlusion of the teeth. Dr. E. H. Angle, Dr. Martin Dewey and others have written upon this subject, reminding us of the importance of the various natural forces, such as cell metabolism, forces of the inclined planes, normal approximal contacts, harmony of shape and sizes of the dental arches, atmospheric pressure, and muscular pressure.

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Forces Affecting Occlusion.

Those elements which have received the greatest share of our practical attention have been the mechanical forces of the inclined planes and the size and shape of the arches. There is one force, however, a thorough comprehension of the importance of which, it seems to me, has failed to penetrate the mind of the orthodontist in general, although it has been often written about. We have been told how occlusal force and muscular pressure aid the teeth in taking very nearly their proper positions in regard to their buccal and lingual relations, and that normal muscular pressure upon the anterior teeth tends to hold them in their normal relation; yet we have found that in many cases where malocclusions have been corrected, where inclined planes, points of contact, and arch forms have been successfully established, the unbalanced muscular forces have still left our cases in a state of semi-treatment.

Angle's Views on the Influence of the Lips.

It is interesting to read Dr. Angle's observations regarding muscular behavior contained in the second chapter of the seventh edition of *"Malocclusion of the Teeth,"* where he says:

"The influence of the lips in modifying the form of the dental arches is an interesting study, and almost every case of malocclusion offers some noticeable and varying manifestation of it."

In speaking of the upper and lower lips, he further says:

> "This force is exerted automatically in response to almost every emotion, and results in maintaining the teeth in harmony with the graceful and beautiful curve of the normal individual arch. In cases of malocclusion, strikingly characteristic abnormalities in lip function are often noticeable, leading to the suspicion that more often than is recognized the peculiarities of the lip function may have been the cause of forcing the teeth into the malpositions they occupy."

The Author's Views.

It avails us little if we diligently seek to place one part of the human machine in harmonious relation, and neglect that other part upon which permanent success depends. As I have already intimated, our teachers have recognized the importance of muscular pressure in its normal conduct as well as in its abnormal conduct, but here they seem to have stopped, assuming that with the correction of the faulty osseous formation and cusp relation, Nature, somehow or other, would establish the correct muscular tone and muscular habits. All of us can recall cases which failed after an unduly prolonged retention,—cases of every class and description. It was because of the recognition of these elements that in 1906, in a paper on "*The Correction of Facial Inharmonies,*" read before the Northeastern Dental Association, I was led to say:—

> "The logical solution of our difficulties, from Nature's standpoint, would consist in inducing every organ to perform the normal degree of functional activity. Would that children lived in a normal and healthy environment, for then, slowly but surely, facial inharmonies and malocclusion would become less and less prevalent.
>
> "We must likewise resort to artificial means in order to stimulate those organs which, having been allowed to degenerate, have failed to perform their natural functions. We must bring into normal position mal-posed teeth, harmonize the distorted arches, and restore the facial lines to their original grace and beauty."

We know that health means harmony of functional adjustment. If disharmony of function reigns in any part of the organism, it means that some form of interference has influenced the harmonious activity of the affected organ. The psychotherapist in his study of the maladjustment of the nervous system seeks to find those elements of interference which tend to unstabilize the normal functional activity of that system. He recognizes that the nervous system is most delicately balanced and in some individuals the merest suggestion of interference may cause the gravest symptoms of disorder. What is true in relation to the psychotherapist in his investigations will be found to be true in the experiences of all men, no matter what part of the human organism they have chosen to place under their particular guardianship.

Duty of the Scientific Orthodontist.

If the orthodontist stops to think, he cannot but come to a sense of realization that all mechanical and muscular adjustments from the grossest to the more delicate, are subjected to disharmonizing influence by myriads of forms of interference whose existence it is his business and duty to investigate. His work should carry him into sympathetic touch with not only the general physician and rhinologist, but with the psychotherapist, the orthopedic surgeon or medical gymnast. In fact, he must have a sympathetic and an open mind toward all sciences which attempt to harmonize the functional activities of the human body.

To enumerate the various forms of interference which are especially significant in our work, would, I think, take too long, but, briefly speaking, we have the mental interferences, evidence of which is seen in various muscular and nervous habits; the respiratory interference, which may be a factor in insufficient bone growth; postural interferences, which throw the organism more or less completely out of mechanical adjustment; the interference in cusp relation, which reacts upon the guiding and developing muscles of the face. When these influences have been grouped, we are interested to observe how they react upon one another, tending always toward further disharmonious action and the final breaking down of the health of the organism.

Benefits of Conscious Muscular Effort.

In our instructions to patients, it is much better for us to strive to direct the patient to comprehend the control and co-ordination of his muscles through conscious, well-directed efforts, than to allow him automatically to perform certain prescribed exercises. This mental and muscle training will not only have a beneficial effect upon those parts about which we are directly concerned, but will be of immense value to him in other important acts of his life. Therefore, before the child is allowed to undertake any form of physical work, he must be brought to a realization of the need and importance of such endeavor. The orthodontist in his contact with his patient must discover for him the defects exemplified by the misuse of the various muscle groups. When this has been accomplished, he should then undertake to teach the patient how to inhibit those sensations which induce him to make an imperfect use of his muscular mechanism. He must be taught to understand the imperfect mechanical relations which exist, and must be given also to understand correctly the positions of mechanical advantage; then, by supplying him with new and correct guiding impulses, he will acquire, in time, the ability to bring about the proper use of his muscular mechanism.

Principles of Muscle Training.

Having, then, before us the principles of procedure, we are prepared to consider their practical application. *The principles are*: *First—The mechanical re-establishment of arch form and cusp relation by the simplest mechanical means, thus removing any interference which tends to discourage the normal functions of the muscles. Second—The principle of muscular balance and mechanical advantage in the complete organism, including special guidance and control of those muscles concerned in the particular weakness upon which our attention is to be directed, urging them on to their normal development and strength until the harmoniously developed face completes the restoration of the organism to its normal inheritance.*

We can readily understand that the motor efficiency of the parts of the body upon which we are directing our attention depends upon the ability of our patient to gradually attain the faculty of directing mental stimuli of sufficient energy to effect their development. It is because of the law of mental growth, known as repetition, that the orthodontist realizes his greatest encouragement regarding this phase of his work, because the things that are done from choice tend to become spontaneous, if often repeated. Therefore, the ability of the muscles to continue the performance of their full functions after repeated efforts of the will, is assured by the educated state of both mind and muscle.

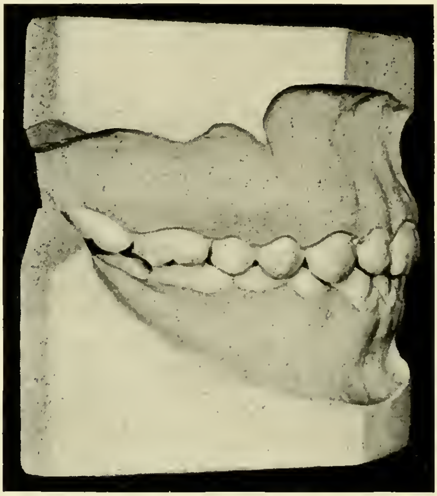

Fig. 1.

With these ideas firmly established in our minds, we can now proceed to consider and illustrate briefly the practical means by which these changes are brought about.

Practical Application of the Principles.

Figure 1 represents what we are pleased to accept as the standard,—the anatomical section of which gives us a comprehensive view of the area over which certain groups of muscles exert their influence. *It is a principle in the procedure of treatment through the stimulation of natural function to rid this space as completely as possible of any apparatus which has a tendency to interfere with the normal action or conscious guidance of the lip and cheek muscles.*

It is unfortunately true, that in many growing cases it is absolutely essential to our ultimate success that we make use of certain forms of mechanical apparatuses; but it is essential so to design them that they will interfere as little as possible with normal muscular activity. Textbooks on orthodontia frequently show illustrations of appliances filling the buccal and lingual spaces. The use of these appliances would not be compatible with the simultaneous encouragement of functional activity of the soft tissue. It would be difficult under such circumstances to train the muscles to a free and unhampered action. In most cases I have found the use of the lingual wire (Fig. 2) to be more nearly in accord with the principles we are considering. In younger cases, where the deciduous teeth are still present, the junior pin-and-tube appliance (Fig. 3) is sometimes made use of during the early stages of treatment. being removed after a sufficient development has been obtained to allow a free eruption of the teeth,—the lingual wire being used on the lower to secure the arch development while the muscles of mastication and expression are being trained to their normal activity. Figure 4 illustrates the advantage to be gained by the use of the lingual wire.

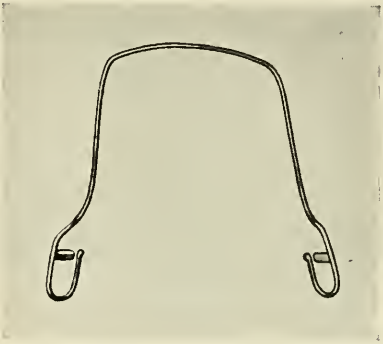

Fig. 2.

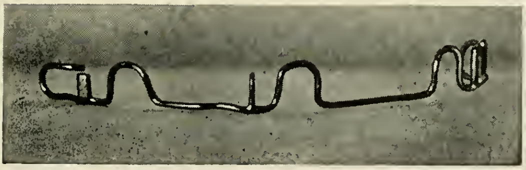

Fig. 3.

"The most valuable appliances are those which interfere least with the normal tendencies of development, and which in their construction and adaptation are freest from interference with muscular activities and habit-forming possibilities. When it is found necessary to interfere with any normal function, whether it be of the tongue, lips or cheeks, some form of compensation must be provided. Possibly an illustration here will help us to grasp my meaning to better purpose. The drawing represented in Figure 5 indicates the direction of the movement for each of the three appliances: Labial wire, pin-and-tube, and lingual wire. It will be seen that with the use of the lingual wire there is greater opportunity for muscular influence in its relation to the individual tooth movement. The expansion arch which for so long a time was our mainstay is, in my opinion, in the light of recent years of experience, a more

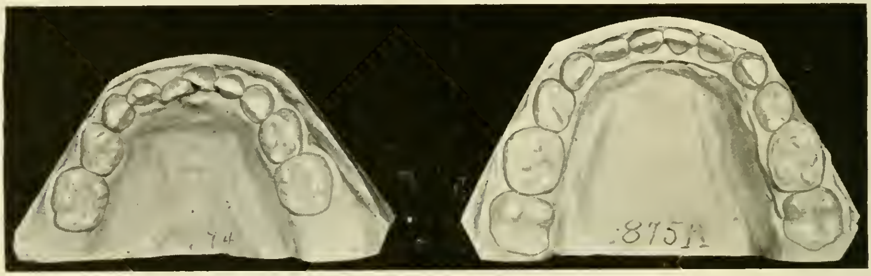

Fig. 4.

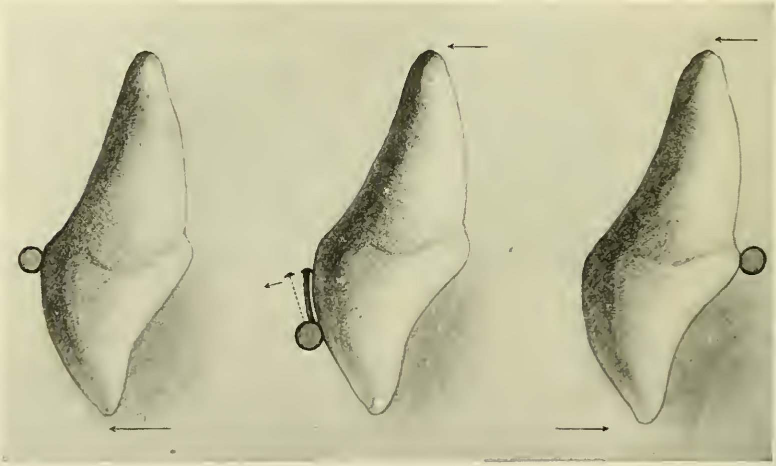

Fig. 5.

or less troublesome appliance; especially in regard to its effect upon the normal action of the lips and cheeks, and most noticeably so when it is poorly adjusted, as is so often the case. It will be seen that this appliance, even when neatly accomplished, interferes and forms a barrier between the lips, cheeks and teeth, so that their normal function is seriously interrupted. On the other hand, the lingual wire can be neatly placed where it gives the minimum interference to muscular action. (Fig. 6.)

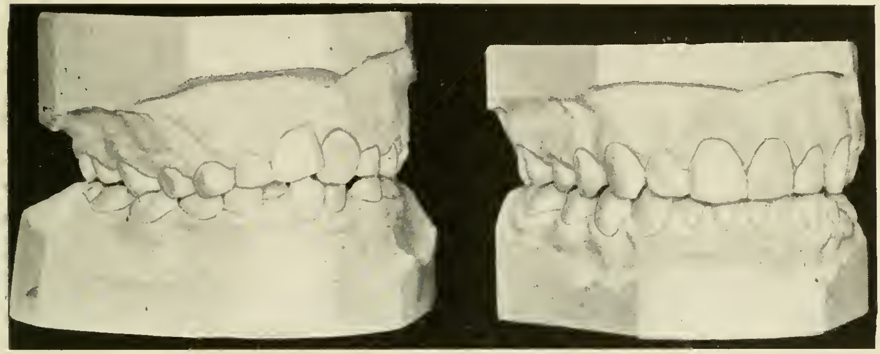

Fig. 6.

Briefly, then, we have considered the advisability of the simplicity of mechanical interference, paving the way in seeking the greatest advantage to be derived from the stimulation of muscular activity. It will be logical now for us to proceed to a consideration of the various muscle groups and the methods best adapted for their proper development.

Consideration of the Various Muscle Groups and Methods Best Adapted for Their Developement.

The orthodontist among his recollections of failures has a keen sense of the presence among that ghostly group of various forms of Class II which have failed after prolonged and conscientious efforts with intermaxillary elastics and various forms of retention. Dr. Angle, in his seventh edition, writing of a case treated without intermaxillary elastics, speaks as follows:

Edward Angle.

"About three years after the discontinuance of retention, on examining the facial lines and the teeth of the patient, an important discovery was made, namely, that although the normal relations had been maintained between the teeth, the mandible had slowly drifted back to probably very nearly its former relations with the skull, but in so doing the crowns of the teeth of the upper arch had been dragged distally to a noticeable degree, while the crowns of the teeth of the lower arch had been tipped forward. In other words, there had been accomplished by the muscles of mastication and persistent, difficult retention, what we now aim to accomplish, and do accomplish, with the Baker anchorage, often in so short a time as three weeks in patients of this age."

Muscle Training.

I have found, as you all have, that the muscular tissues of the face, where they have once acquired the habit of bad behavior, do not readily assume the normal. That some form of training was necessary became very apparent, and with this conviction firmly established, I proceeded to formulate and practice definite forms of muscle-culture for the facial muscles. I soon found that in order to be successful in this branch of the work, it was necessary to make careful study of the various adjustments of the muscle groups, and that in order to obtain proper muscular control, we must also seek to obtain satisfactory mental control. Also, that it is necessary, at the outset, in order to obtain results, that the parent and the child be convinced of the importance of the work and be given their part in the responsibility for future success or failure.

In some forms of malocclusion, the unfavorable position in which muscles appeared to be placed to perform that particular work which they were supposed to do was apparent, and I became strongly convinced that these intricate muscles must be carefully trained in order to assume the correct positions in which their normal actions would place them. I soon discovered that ordinary muscle culture would not bring the desired results as quickly or as permanently as a thorough practice of conscious control over the facial muscles. The object of my efforts has been to teach those patients in need of this form of treatment to consciously use the muscles and forces of occlusion, after first being instructed as to their proper positions.

This muscular work, of course, must go along hand in hand with the mechanical treatment of the case, and no undue muscular pressure must be allowed until the patient has learned to place the arches in their proper relation, which function is taught to them after the major interferences have been removed. The object of the work is to so strengthen the muscles of mastication that they will assume their normal function, not only resulting in a maintenance of occlusion, but in building a stronger masticatory apparatus as well,—that the so-called muscles of expression shall be so trained as to be under conscious control, and not allowed to "run riot in response to almost every emotion."

It can be readily understood, then, that we are justified in concluding that our work will be even more greatly enhanced if we are able to obtain the harmonious development of the entire organism. *We have accustomed ourselves to think so exclusively of the region of our special effort, that we fail many times to realize that Nature works as a whole. Now, in order to eradicate any special difficulty, it will be well if, in the young, we can obtain a correct mechanical co-relation of all parts of the organism.* In order to obtain these great advantages, we must begin at once to consider the value of conscious control in its relation to our work.

F. M. Alexander's Views.

F. M. Alexander, in his recent work, *"Man's Supreme Inheritance,"* says:—

> "The failure of subconscious guidance in modern civilization is now being widely admitted, and the consideration of this fact has led a few to the logical conclusion that conscious guidance and control is the one method of adapting ourselves not only to present conditions, but to any possible conditions that may arise. . : ."
>
> "For in the mind of man lies the secret of his ability to resist, to conquer and finally to govern the circumstance of his life, and only by the discovery of that secret will he ever be able to realize completely the perfect condition of *mens sana in corpore sano."*

Kinesiology.

It will be essential for the orthodontist of the future to add the science of kinesiology to his course of studies. This science deals with the study of muscular movement, and includes consideration of muscular exercises of all kinds,—the reasons why they are performed, their correct performance, and their reactions.

He will learn from this study much that will be of value to him regarding various defects and their cures. In the future, I believe, the student of orthodontia will be called upon to make analysis of complex muscular movements, noting carefully the muscles that are involved, and the scope of their influence, applying this knowledge to the muscles of the face. He will soon learn that the work accomplished by the muscles reacts again upon these muscles, developing them and establishing a greater efficiency in action. He will learn that the reactions are not only developmental, but that they are also mechanical by the influence and the relationship which exists between the joints and the shapes of the bones themselves.

The orthodontist, then, in order to become completely efficient, will need to understand muscles in their various conditions, and will need, during his treatment of a given case, to have their intricate influences constantly before him. His study of anatomy, myology and physiology will take on a new interest, because he will have a definite, well-defined reason for understanding the muscles and their function. Giving attention to this subject, it will soon be discovered that the ability to analyze and solve the various problems of muscular action will not be so easy, because there is an infinite variety of movements and change in form, all of which have their influence in young childhood when they play over and upon the delicate osseous development of the tissues of the face.

Gum-Chewing Not Scientific Muscle Training.

The study of this subject is fascinating, because of the intricate and exquisite adjustments that may be discovered. In this relation, I would like to call the attention of my readers to the danger of misapprehending the essence of scientific muscle culture. I was reminded of this at a meeting at which I read a paper upon this subject. An orthodontist present remarked in the discussion that the act of chewing gum seemed to him in line with the work which I was advocating regarding muscle culture. I should dislike very much to have this empirical view of such important work become prevalent. for the reason, first, that the act of chewing gum for the development of the uncultured muscles is essentially non-scientific, and may be productive of much harm. Somewhere it has been written and emphasized that when inclined planes have assumed an unnatural position, the more they are used, the more severe the malocclusion is apt to become. This is because they are in a position of mechanical disadvantage. To thoughtlessly prescribe a course of gum-chewing to a little patient suffering from a developing Class II malocclusion would indeed be poor professional advice. It would be equally disastrous if a patient suffering from a developing Class III, or even a Class I malocclusion, were to be subjected to an undue amount of muscle tension, with its mal-influence upon the mechanical disadvantage exemplified by the mal-occluding planes.

After the arches have been developed and the patient has acquired the ability to place the arches and inclined planes in proper relation with one another, a gum-chewing prescription might have some excuse, but even then it is of doubtful value. We are not quite sure that it is a good thing for the digestive apparatus to be subjected to an increased flow of saliva when the natural functions of the alimentary canal do not at that time call for this flow. Nor are we sure that the salivary glands would take kindly to a prolonged course of this kind of treatment and submit gracefully to an overstimulation of their function. It is, moreover, true that the child is apt to develop one side of the mouth much more than the opposite side. Again, it becomes a subconscious habit and loses that particular value which is to be derived from the conscious control which results in a harmonious unification in the development of all the muscles involved.

Failures of this nature would be much less common if the orthodontist understood and applied the principle of conscious control of the muscles of mastication, training them and causing them to do the greatest activity in their normal position. The evident failure in this case was due to an abnormal action of the muscles of mastication, which might have been corrected had the proper attention been given them. It is interesting for us to note at this point in the discussion what Herbert Spencer has to say regarding situations of this nature, taken in a broad sense. He writes:—

Herbert Spencer

> "Each faculty acquires fitness for its function by performing its function; and if its function is performed for it by a substituted agency, none of the required adjustment of nature takes place, but the natural becomes deformed to fit the artificial arrangement instead of the natural arrangements."

Dangers of Intermaxillary Elastics.

Frequently, by the use of intermaxillary elastics, arches are more or less misshapen on account of the unusual strain brought about by the extreme force which is required if the intermaxillary elastics are to overcome the triple resistance of mind, muscle and malposed teeth.

In the early stages of treatment in these cases the patient may be trained to overcome the handicap by applying proper mental stimuli; and when the time appears when proper adjustment of the mandible with the rest of the skull is possible, the adjustment takes place quite normally, and then, if it is supplemented by the strengthening of the masseter and temporal muscles, results are permanent and more beautiful because of the harmonious development and action. In contemplating work of this nature, the orthodontist must ever bear in mind the fact that muscles tend to stay in the position in which they do their most and hardest work, and that this work must be done with the arches in their true relation one to the other, for it is then that the masticatory apparatus has assumed the position of mechanical advantage, and it will be surprising how quickly the various muscle groups will respond to the work thus

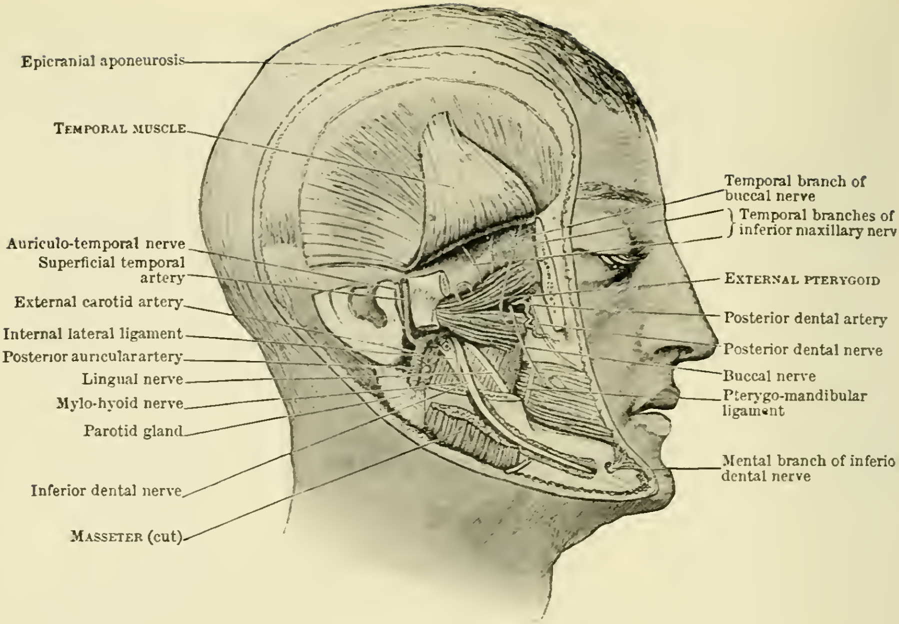

Fig. 7.

placed upon them, because they are in the position which Nature has intended that they should occupy.

The External and Internal Pterygoids.

It will be logical for us at this point to direct our attention to that most important group of muscles.—the external and internal pterygoids (Fig. 7). The advantageous positions which Nature has given these groups will be readily seen. They are the muscles which control the movements of the mandible. During early life they are readily controlled, which accounts largely for the fact that they often give way to the suggestions furnished them by slight interferences incident upon the narrowing of the upper arch and by the interference of the upper lateral incisors in lingual occlusion. If the mandible is forced into distal position, these muscles soon form the habit of keeping it there. It may be well for me at this point to emphasize the importance of the early exercise of these muscles in cases where it is required. This is true even where intermaxillary elastics are proposed, or where inclined planes upon the anterior teeth are contemplated (Fig. 8). Particularly is this necessary when we contemplate the changes that take place in the glenoid fossa as the child grows to maturity. In treating younger cases you have all experienced the voluntary shifting of the mandible upon the removal of the interference frequently caused by an abnormal narrow upper arch, or perhaps the interference of upper lateral incisors in lingual position. The voluntary change does not take place so readily in older children, for the reason that the glenoid fossa has become of such shape as to discourage the pterygoid muscles in overcoming the handicap. It is good practice in cases of Class II to train these muscles through exercise, so that the proper position of the mandible is readily taken when opportunity is afforded. It not only relieves strain upon the teeth, but avoids many other complications. Of course, there are cases in which light intermaxillary elastics will be of advantage. In changing our methods of practice, it is not always wise to jump abruptly from one idea to another until we have made so sure of our footing that there is little danger of failure. When intermaxillary elastics are to be used, it seems to me that the operator should study to make his use of them as light and their period of use as short as possible. The exercise of the pterygoid muscles previous to the application of inclined planes on the anterior teeth I have found of great service, as the mandible may be readily trained to take the forward position, avoiding greatly the strain

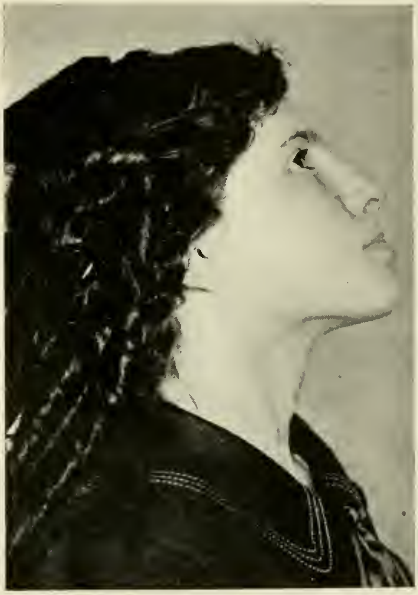

Fig. 8.

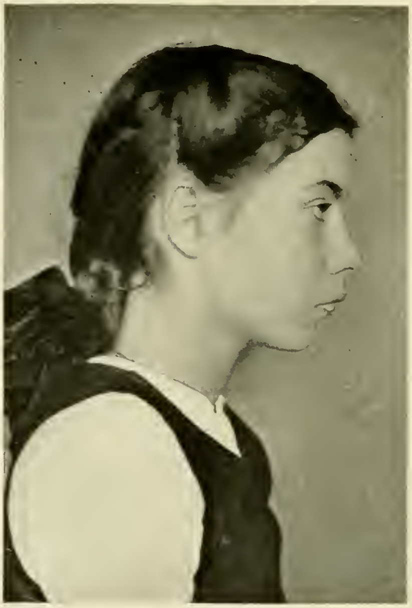

Fig. 9A.

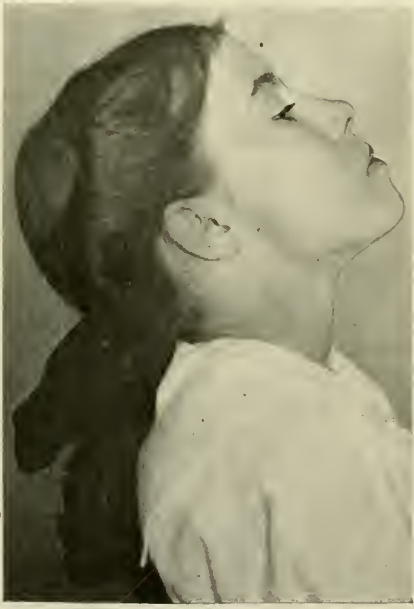

Fig. 9B.

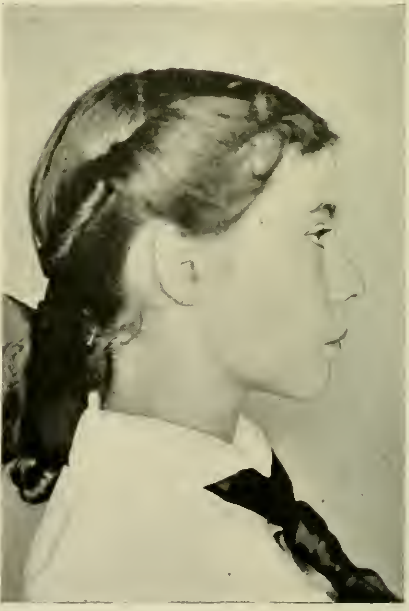

Fig. 9C.

which is usually heaped upon the incisors, if this form of apparatus is placed upon them without taking this precaution. Viewing these illustrations, and reviewing the possibilities consequent upon the control of these muscles, it will, it seems to me, be logical for us to regard them as the intermaxillary elastics of Nature. And I believe you will agree with me that when they have been trained to perform their functions accurately and well, they may be depended upon to furnish us a guarantee of unusual merit for the permanence of our treatment. The exercise of these muscles consists in throwing the mandible forward, as shown in figure 9. The patient requiring this form of exercise is instructed to throw the mandible forward as far as possible, or until the lower

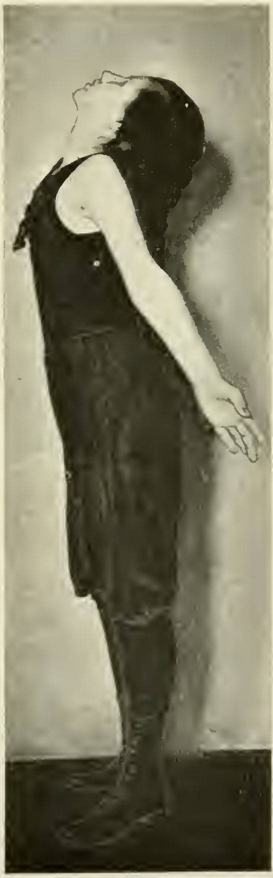

Fig. 10.

anterior teeth are placed in labial occlusion to the uppers, and held there for ten or more seconds and then slightly relaxed. The effort is then repeated as many times as the nature of the case requires. In some cases this will at first be found impossible, but after practice the work becomes easy. This form of exercise is usually prescribed in cases of distal occlusion, and the operator must here be careful in his diagnosis.

The liability of over-stimulating these muscles in the very young will be obvious to any of you who have thought at all upon this subject. A very little of this exercise is sufficient in some, while in others it is almost impossible to overdo it. Still further efforts are made for some patients. as shown in figure 10, which shows a combination of a posture exercise of unusual merit, and the pterygoid exercise. The patient is directed, after taking the position here illustrated, to stretch the point of the chin upward as far as possible, bringing vigorous strain upon the platysma myoides. Figure 11 gives an example of the improved condition after a few months of this exercise in a case of Class II. The only apparatus used in this instance was the upper lingual wire, through the instrumentality of which the interference of a narrowed arch was removed.

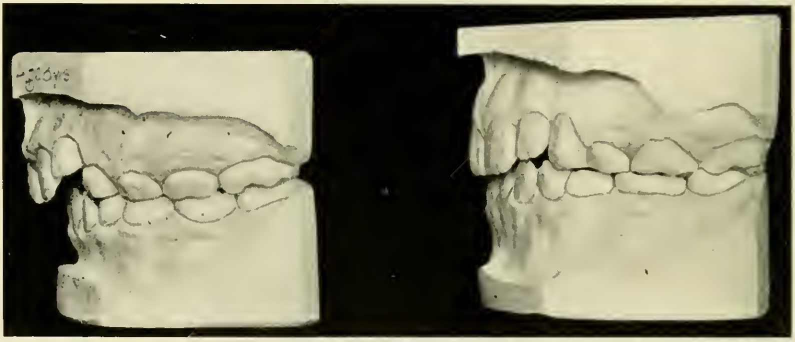

Fig. 11.

Exercise for Temporal and Masseter Muscles.

After the ability to place the teeth in proper relation had been acquired, the patient had another exercise added,—that of the temporal and masseter muscles. This exercise consists of holding the teeth firmly in occlusion and alternately contracting and relaxing the groups of muscles shown in figure 12. In many cases it will be found that the ability to contract these muscles is very slight indeed, but after a few months of practice, the operator is gratified to find greatly increased tone and improved control, as is shown by the ability to contract and relax. All efforts must be made with great concentration.

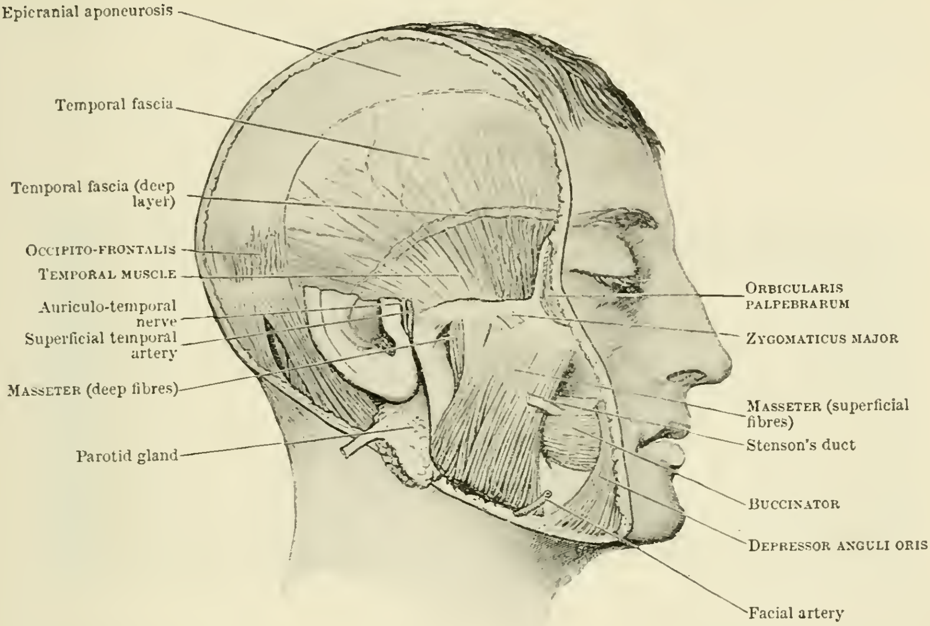

Fig. 12.

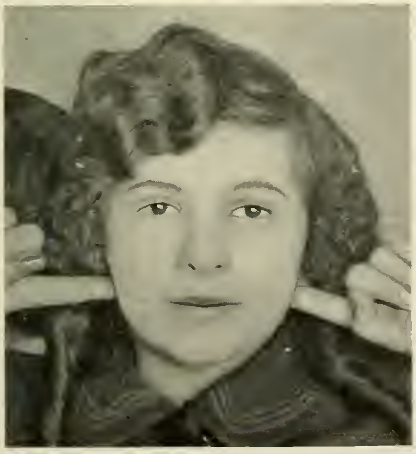

Fig. 13.

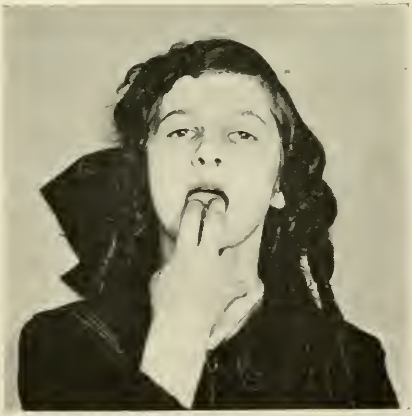

Fig. 14.

and must be complete in their relaxation and their contraction. The ability to completely relax these muscles between each impulse is important to secure, as muscles exercised in this manner, for physiological reasons, grow stronger much more quickly.

Figure 13 shows a child in the act of stimulating these groups. The position of the fingers is useful, in the beginning, in teaching the child to detect the movements.

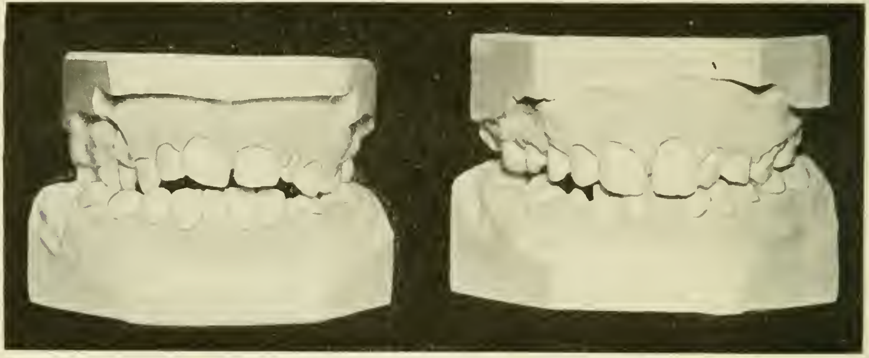

Fig. 15.

Figure 14 shows a form of exercise for these muscles which may be given when it is not wise to place the teeth in occlusion, and is used sometimes in anticipation of the exercise just described. It is performed by directing the child to pit the muscles of mastication against those of the hand and arm, alternately contracting and relaxing.

Figure 15 illustrates a case of a young child ten years of age, who was suffering from lingual occlusion of the upper bicuspids and molars. By the use of the lingual wire the upper arch was expanded until the lingual occlusion was disposed of. When this point of development was reached, as you will all readily understand, the condition of the open-bite was much exaggerated, and this is when the patient was instructed in the use of the exercise of the temporal and masseter muscles. The figure on the right represents this same case a few months later, showing the correction of the open-bite brought about solely by this means. The child's ability to masticate has been wonderfully improved, and it may be said in passing that the high degree of nervous irritability, present at the start, has largely disappeared, and the child shows a generally improved physical condition.

Figure 16 gives a general view of the lesser groups of muscles, which are nevertheless important to the orthodontist. They consist of

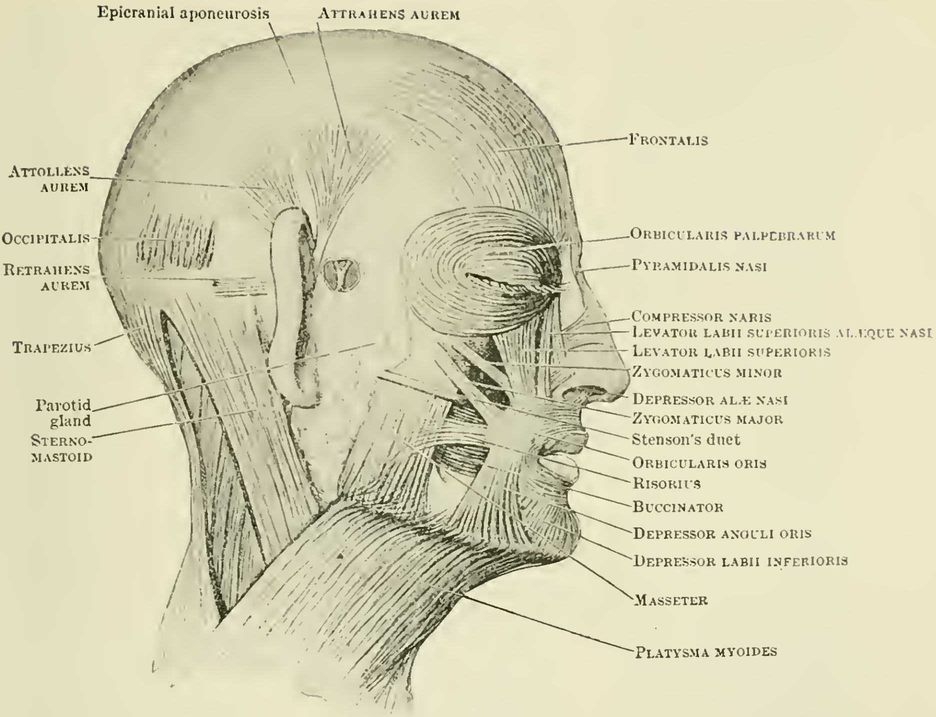

Fig. 16.

the levator labii, depressor labii, zygomaticus, orbicularis oris and platysma myoides. The names of some of these muscles indicate their function, and are perfectly well known to you. If they lack tone, or are not under control of the nervous system, they are the muscles which are most apt to place perplexing problems before orthodontists. Most of these muscles are in some way attached to the orbicularis oris, and when we have a general lack of tone in all these muscles, there is sure to be lack of balance between them and the inner forces, such as the tongue. There are numerous exercises which can be used for stimulation of these groups, but it is not my purpose in this paper to deal particularly with these exercises.

Influence of the Orbicularis Oris.

It might be well, however, for us to direct our attention to the orbicularis oris. Many of you, no doubt, have had difficulty in retaining the upper incisors in correct position. It is necessary, frequently, to apply retaining apparatus to effect this purpose, but if, in the meantime, this muscle has not been strengthened, in case it originally lacked tone, upon the removal of the retaining apparatus the incisors again become protruded. I have several cases in my practice where better results have been obtained in cases of this character without any retaining apparatus at all. One particularly obstinate case yielded to treatment applied for the strengthening of the orbicularis oris muscle. One valuable exercise I have found for strengthening this muscle is shown in Figure 17, and consists in pitting the strength of the thumb and first finger, or two first fingers, against the contractile forces of this muscle. Care must be taken in the performance of this exercise not to stretch, but rather to contract, the muscle around slightly separated fingers; thus ensues a contest of strength between the orbicularis oris and the muscles of the fingers.

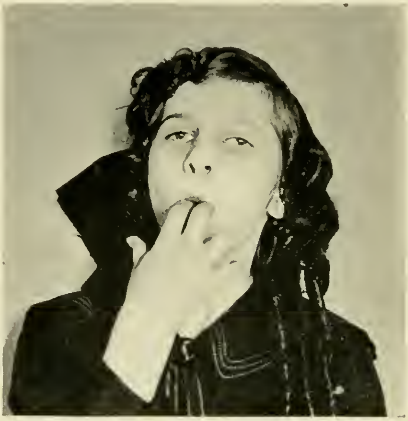

Fig. 17.

Tonic Exercise.

It is frequently found necessary to prescribe a tonic exercise, which I have termed the exercise for general facial development. This exercise influences not only the orbicularis oris, but also the buccinator and all the small ribbon muscles which enter into a combination with the orbicularis oris. It consists in the use of warm water at a temperature which is bearable to the mucous membrane of the mouth, and in which has been dissolved a small portion of bicarbonate of soda. The patient is directed to take a sip of this solution, closing the teeth firmly in position, and with great energy forcing the liquid from the lingual cavity into the buccal. The exercise is usually done five times, morning and night. The patient is directed to continue each exercise until the muscles are slightly fatigued. A not unpleasant aching sensation is the indicator of the successful

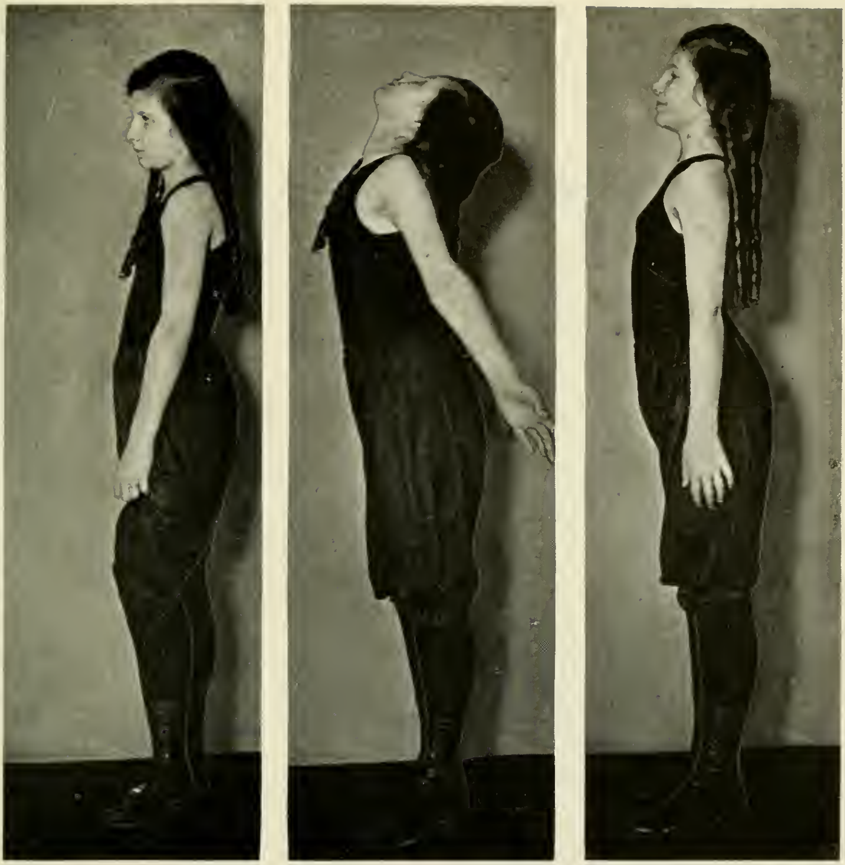

Fig. 18.

effort. The heated liquid adds a distinct advantage to this exercise, as it has a tendency to dilate the blood-vessels, thus producing a more copious supply of nutritive material. At the termination of this exercise, the face will be found to glow with warmth.

The Platysma Myoides.

The platysma myoides is a muscle which, to my mind, is of great importance when considering the correction of faults in the facial muscular development. This muscle has no bony attachments, but is inserted in the fascia and skin of the pectoral and deltoid muscles of the chest and upper shoulder at one end, and at its facial extremity is inserted by many fibres into the orbicularis oris and some of the other muscles upon or near their entrance into the same. It will then be seen that, if this muscle is contracted in its length by the bad posture of the patient, it has a tendency to stretch the weakened muscles of the face in directions which bring gentle but harmful pressure upon the fragile bony structure of the child's face. The exercise for this muscle is found in the general posture exercise illustrated in Figure 18, which consists in having

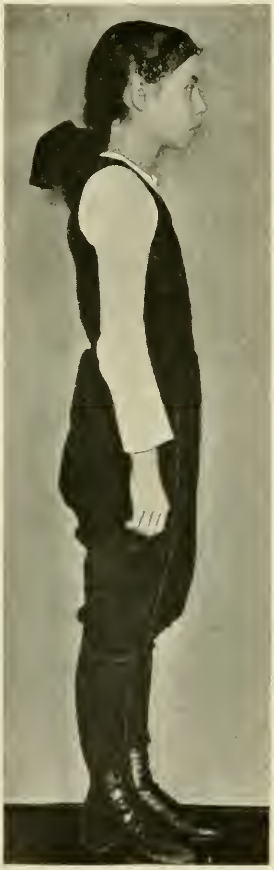

Fig. 19.

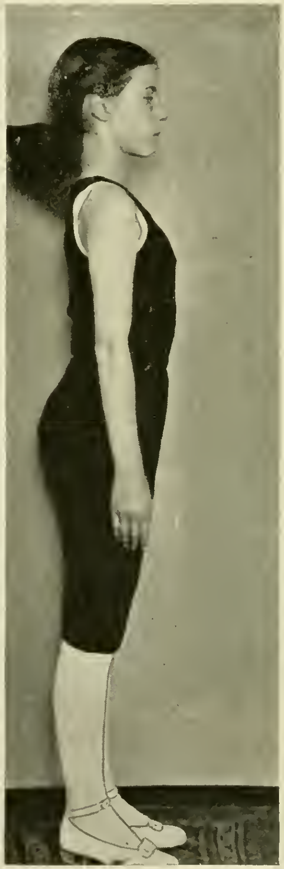

Fig. 20.

the patient stand with feet together, hips slightly thrown back, directing the child to look straight to the zenith, at the same time drawing in the abdominal wall and turning the palms of the hands outward, making a slow and positive stretching motion with the tips of the fingers and the point of the chin. The child is then directed to relax somewhat, bringing the head and arms to erect position,—then repeating the impulse. This exercise is done at first a few times in the morning upon arising, and a few times before retiring, the number being increased until the child is able to do it sixty to one hundred times a day. It is important in this exercise that the child be not allowed to curve the vertebræ so that the back represents much of a concavity. To avoid this, the child is directed, when drawing in the abdominal wall, to tighten, at the same time, the muscles of the buttocks. A slight forward movement of the body, bending slightly at the ankles, thus bringing the weight of the body slightly upon the balls of the feet enhances the position of mechanical advantage in this exercise.

Fig. 21.

When a child is born, the earnest wish and hope of father and mother is that the child shall represent not only physical perfection, but mental strength as well. But the unconscious child has many an obstacle placed in his way by reason of the malevolent influences of civilized existence. His habits of body and mind, his tricks and manners of speech, the performance of his muscular acts, are allowed to develop without a conscious control. He has about him myriads of people, presenting to him for his imitation, imperfect models. The parents very often are the greatest sinners in this regard. And so the sub-consciously influenced organism develops more often than not along the road toward ill-health, completely unconscious of his own bodily disadvantages and mental handicap. Our schools struggle with backward children,—backward in mind and body. There is some encouragement in the thought that there can be seen at the present time a tendency toward a re-education both mental and physical.

The child whose picture I shall now show you represents a type which is all too prevalent among the children of today. (Fig. 19.) This child's history will be interesting for brief consideration. It will be readily noticed that not only the muscles of her face are maladjusted, but that there is no evidence of mechanical muscular balance throughout the whole body. Mr. Alexander says, in referring to children of this type:

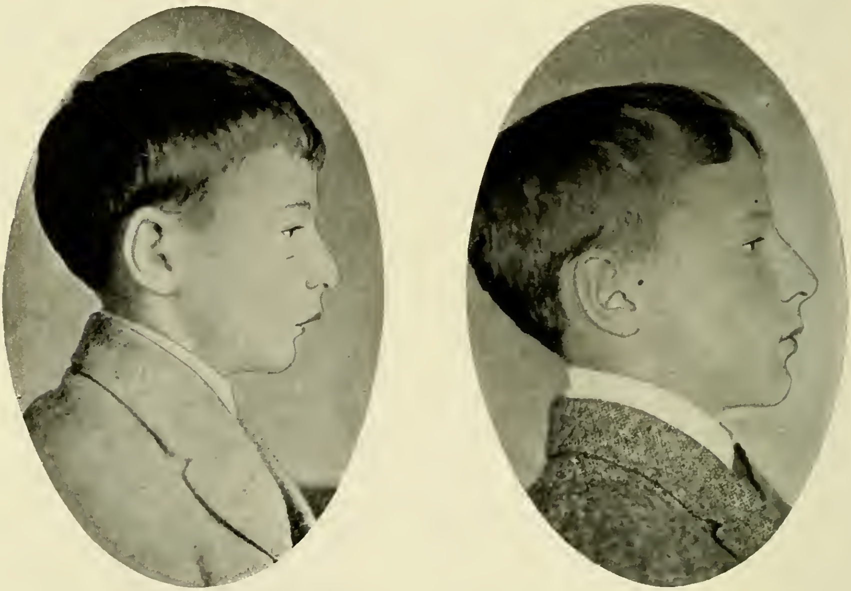

Fig. 22.

> "The child of the present day, once it has emerged from its first state of absolute helplessness, and before it has been trained and coerced into certain mental and physical habits, is the most plastic and adaptable of living things. At this stage the complete potentiality of conscious control is present, but can only be developed by the eradication of certain hereditary tendencies or predispositions. Unfortunately, the usual procedure is to thrust certain habits upon it without the least consideration of cause and effect, and to insist upon these habits until they have become subconscious and have passed from the region of intellectual guidance."

I next invite you to study the picture of this same child, after two months' following the instructions that I had given her respecting conscious guidance over muscular activity, together with orthodontic treatment for the correction of the mal-development of the bones of the face and malocclusion of the teeth. (Compare Figs. 19 and 20.) The exercise, which this child has been taught to undergo, consists in gaining control of the pterygoid muscles and control of the muscles of the trunk, particularly those of the abdomen. The picture showing the great improvement in this child does not represent the conclusion of the treatment, but simply records the physical condition after two months of conscientious effort. The marked improvement in her physical being has its counterpart in her mental development, also. This was first noticed by the parents when their habituality backward child began to bring home reports of a very different mental alertness. The child's outlook on life has also shown a vast change, and she is learning to use those powers of mind which are responsible for right development physically, mentally and morally. Her obedience to my requests is prompt and earnest. This I have found generally true with all children who are not, by reason of some unfortunate taint, incapable of realizing the benefits which are bound to occur from this rational line of treatment.

Case Histories.

The brief history of a few more cases will be interesting to you, I hope. It will be well at the outset for me to say that all of the three cases which I shall now present to you are undergoing treatment along the general lines which I have indicated. The first is a type of case common in your practice,—a child who has been operated upon by a skilful surgeon for the removal of adenoids and tonsils, and who has made the same mistake that the orthodontist has made in assuming that the child somehow or other subconsciously gains control of the distorted and ill-draped facial muscles. The interesting point about this child is that, being a sub-division of Class II, with upper laterals in slightly lingual occlusion, she is being treated without any apparatus whatever, and satisfactory progress is being obtained. The lapse of time between these two pictures (Fig. 21) represents a period of about six weeks. Her distal occlusion is no longer apparent; the muscles of her face are becoming firm and well-established in their normal positions. This is evidenced not only by the improved muscular balance of the orbicularis oris and its attached muscles, but also by the improved contour in the region occupied by the masseter muscle. The exercises which this child is undergoing are the general posture exercise, the pterygoid exercise, masseter exercise, and exercise for the tongue, in obtaining and maintaining the full development of the lower arch, and balancing the forces of occlusion brought into existence by the control of the masseter and temporal group.

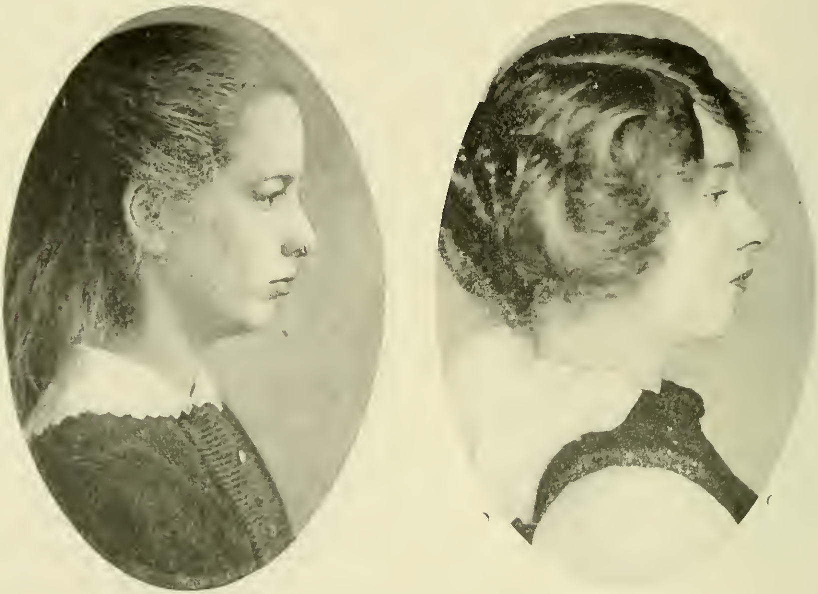

Fig. 23.

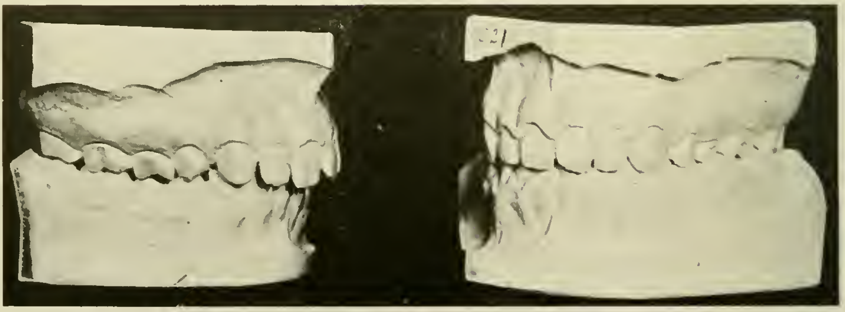

Fig. 24.

This illustration, Figure 22, is of a boy eleven years of age,—an extreme case of Class II, one of those cases where the persistent use of intermaxillary elastics, followed by a long course of mechanical retention, is so often unavailing. The treatment of this case consisted in using the general posture exercise and the pterygoid exercise. Later on, when the muscles had become accustomed to placing the mandible in its normal relation with the rest of the skull, small inclined planes were placed upon the anterior teeth. His future treatment will consist of a continuation of these exercises, with the addition of the temporal and masseter and those of the muscles of expression, including the orbicularis oris.

In Figure 23, the profile on the left shows a child with slight distal occlusion. It will be noticed that the muscles around the mouth are poorly developed, and evidently not under proper nervous control. The picture on the right shows this same patient after completion of the treatment. This patient has now very satisfactory muscular development. The figure on the right also shows the improved contour and the more normal nervous control of the muscles of the face. This patient has developed an unusually fine set of masticatory muscles where, when the case was started, these muscles showed very little development. In Figure 24 the model on the left shows this case before treatment, and on the right the result at the completion of the treatment.

I have reserved for your consideration a case (Fig. 25) which has given me much encouragement, and I feel that this child, like those of the three preceding cases, has been doing and is doing her part in helping to establish the importance of the theories which I have been presenting to you today. They have all four been faithful and earnest in the application of the advice I have been giving them, and their mental alertness and interest have gone apace with their improved mental condition. This child, as you see her, before supplying the rational treatment, suffered from a severe case of protrusion of both upper and lower incisors. She was treated and teeth retained over a period of several years by a man of unusual attainment in orthodontia, but the muscles were not trained nor developed in any way. The difference in time between the first and last pictures (Figs. 25 A and B) represents a period of about ten months, and the satisfactory result with respect to the correction of malocclusion is found in the fact that no mechanical retention has been necessary in order to maintain both the upper and lower incisors in their normal position. The difference in muscle tone and control between the first and last picture has been sufficient for the purpose of retention. It will hardly be necessary for me to indicate definitely the other points of improvement in this face; the more you

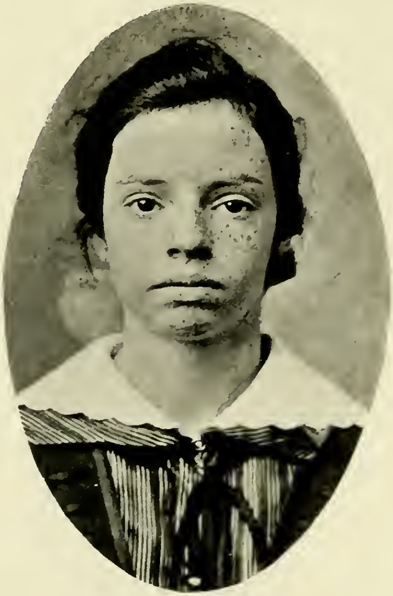
Fig. 25A.

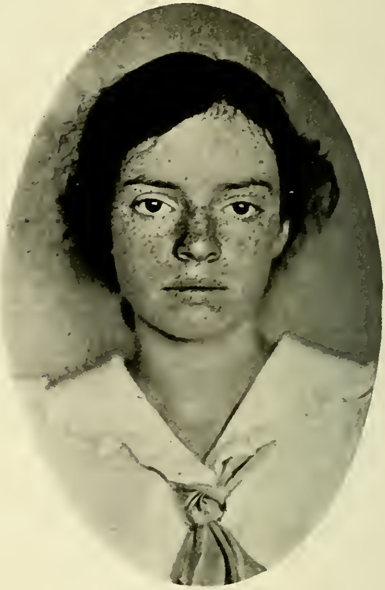
Fig. 25B.

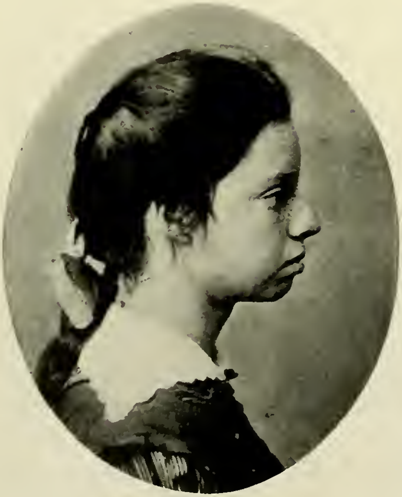
Fig. 26A.

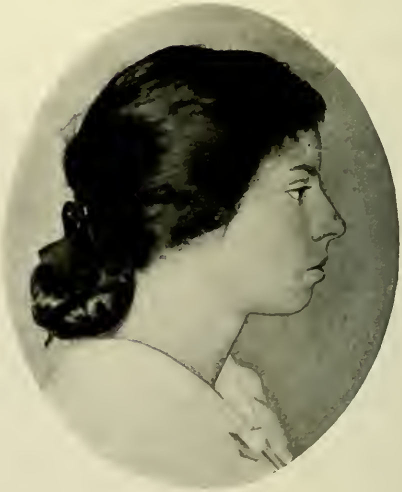
Fig. 26B.

study, the more nearly it will be seen to approach the graceful, well-poised face that Nature intended this girl to enjoy. A contemplation of side views of this same patient (Figs. 26 A and B), representing the same period of treatment, will be found even more interesting than the study of the front views. The muscular improvement will be seen to have taken place in the masseter, submandibular, synthesis, orbicularis oris, and the nose. All these points show marked improvement upon a casual examination. The improvement in the tone of the muscles evident upon a digital examination is quite marked.

It will not be necessary for me to go further in order to convince you of the value of these experiences along the line of muscular control in conjunction with a simplicity in the construction and manipulation of orthodontic appliances. I believe that I can not do better in closing my paper than to leave with you a quotation from Mr. Alexander, which embraces in its meaning the basis for important development in our work with children:

> "It is the wish, the conscious desire to do a thing or think a thing, which results in adequate performance."

520 Beacon Street, Boston, Mass.

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Stereoscopic Roentgenology.
Stereographs.

By C. Edmund Kells, D.D.S., New Orleans, La.

Nomenclature. Immediately upon Roentgen's discovery of what he modestly termed the "X-Ray," by means of which it became possible to take pictures of the invisible, it became necessary to give these pictures a name.

Skiagraph, skiagram, radiograph, radiogram, and others were suggested, and in this country the first name was the generally accepted term, for the first few years after the discovery of the X-Ray.

Skiagraph is from the Greek, means shadow picture, and these are shadow pictures and nothing else.

A disposition was also shown by the early workers to honor the discoverer in this matter, and Roentgenogram and Roentgenograph were suggested, but these are time-consuming terms, and anything but euphonious words, and so, as has just been stated, the term skiagraph was mostly used. Later on, however, radiograph began to be used as well, and today both terms are generally used.

However, there was soon organized (about the year 1900) a society known as the American Roentgen-Ray Society, of which your essayist was an early member. This association is in existence today and is composed of physicians who specialize in the use of the Roentgen-ray, so that the choice of the nomenclature of the science naturally falls within its province.

The American Roentgen-ray Society is composed of Roentgenologists. Its official organ is *The American Journal of Roentgenology.* When exposing plates to the influence of the X-Ray, its members produce Roentgenograms. At other times they use Roentgenographical methods. Roentgenoscopy is probably daily saving the lives or limbs of some of the best of those who have gone "over there." "Roentgentherapy" is now practiced practically all over the world, or if not quite that, then at least everywhere where it is worth while.

While all this is true, yet there is no law in existence making it a misdemeanor for a dentist to call his Roentgenogram, a radiograph or a skiagraph, or anything else he may choose to miscall it, and, likewise, when he writes a book he can give to it any title he may select, but when we meet with such a one as "Oral Roentgenology," then we recognize the fact that its author, at least, believes in correct nomenclature.

As for your essayist, he apologetically admits Roentgenogram always was "too many" for him, and so he always has used skiagraph, and probably will keep on with it till the end.

However, a strange occurrence can now be reported in this connection. Just before this country joined in the world-wide conflagration, the "Intellectuals" of Germany, as they were called, and who were some ninety in number, signed a statement upholding the Kaiser in his course and approving of his conduct toward Belgium.

Now, as a rule, the ultra-scientist is no respecter of creeds, religion or politics, and mixes with neither, and, therefore, when these ninety "Intellectuals" thus went out of their sphere, it produced a mighty impression—and a mighty unfavorable one as well—upon the intellectuals of other countries, and since then there has been a tendency to drop everything that sounds German, and so today the word *Skiagraph* is slowly replacing Roentgenograph among Roentgenologists. (This, of course, is only hearsay.) Whether or not they will ever succeed in getting away from the present very German nomenclature remains to be seen.

So while the invitation to be with you here this evening called for a demonstration of stereoscopic-radiography, it is to be hoped that the same demonstration under a different name will be acceptable—"A rose by any other name would smell as sweet."

When stereoscopic work was first undertaken, a shorter term than "stereoscopic skiagraph" was necessarily required for its description, and so your essayist adopted the word "stereograph," which he has used ever since, and he trusts it will be acceptable to this society.

Dental Skiagraphy.

When a properly prepared and protected photographic film is placed within the mouth and duly exposed to the influence of the X-Ray, a plain shadow picture is the result, which, while limited in its character, is usually valuable to the dentist.

If we now apply the laws which govern stereoscopic photography to this same work, we then increase the value of our pictures a hundredfold and even more, or, to be more precise, there is absolutely no comparison between a plain skiagraph and a stereograph, for while in a given case a plain skiagraph may happen to be of absolutely no value, a stereograph may reveal the conditions sought.

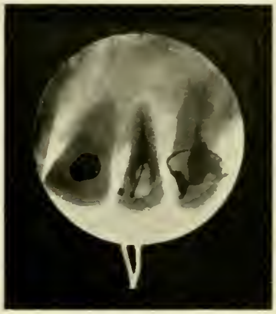

Fig. 1.

Dental Stereographs.

All that it is really necessary to know now about this work is that two ordinary skiagraphs of the region involved must be taken upon separate films from points about two and one-half inches (the pupillary distance) apart. The distance from the film to the tube does not appear to affect the result, but probably from ten to twelve inches is the best measurement for this line.

The patient must not move during the process of changing the films, and the second film should be placed in about the same position as the first and *exactly upon the same plane.* Here lies the difficulty in taking many dental stereographs upon films within the mouth.

These stereographs upon films within the mouth were first taken by your essayist more than sixteen years ago. It is unnecessary to occupy valuable time by the recital of the many trials and tribulations which were undergone, or to describe the various complex and difficult stages which were successively gone through with before this simple method now used was finally devised.

Figure 1 shows a plain, everyday skiagraph, and before this picture can be of any use it must be interpreted. As a matter of fact, we hear much these days of the correct *interpretation* of skiagraphs, but the correct interpretation of the skiagraph is frequently a very uncertain proposition.

The reason why Fig. 1 requires "interpretation" is because it is merely a shadow picture—does not explain itself upon its face—and as a matter of fact, it is impossible to make a correct interpretation because no one but the man who took it can recognize the actual conditions which it portrays. He and no one else can correctly interpret that particular picture.

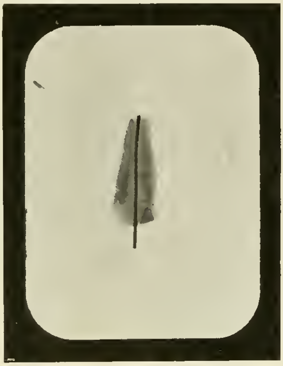

Fig. 2A.

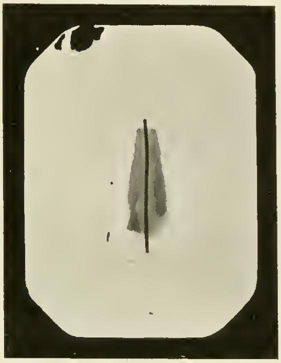

Fig. 2B.

Generally speaking, one could safely say that he recognizes the shadows of an upper central, a lateral and a cuspid. We have all seen so many pictures similar to this one that it would probably be safe to go into court and swear to these facts.

But what about the shadow which *may* represent a wire running into the root canal of the lateral? Where is the man who, looking at this picture for the first time, can go into court and swear whether the wire lies mesially or distally to the tooth, or in its root canal? Such a man cannot be found, because in either case the shadow would be the same, and it is impossible to tell *from the picture* the relative position of this wire to the tooth.

To prove this statement, we will now look at two skiagraphs of the same tooth, with a wire in different positions (Fig. 2, A and B), and no one can tell the difference between them, or the relative position of either wire.

But pair the picture shown in Fig. 1 with the stereoscopic mate, place them in their proper positions in a stereoscope, and after careful examination, there probably is not a man in this room who could not go into court and swear just exactly where the wire was when the picture was taken. This shows the value of a stereograph.

Let us quote from a paper which appeared in the Dental Items of Interest, February, 1917: "The writer firmly believes that stereographic work is not generally done by the strenuous advocates of X-Ray work (this referred to root canal artists), because it is comparatively difficult."

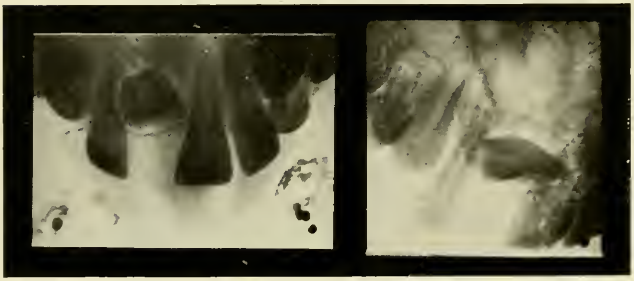

Fig. 3.

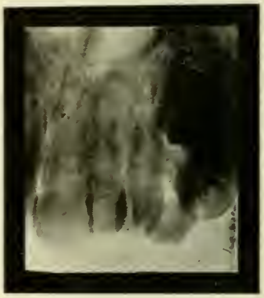

Fig. 4.

"For illuminating a case under consideration, a plain skiagraph will compare to a stereograph about as the moon on a cloudy night compares to the noon day sun in a cloudless sky, and he firmly believes that just as soon as some one discovers an easy way to take and view stereos, the plain skiagraph will be immediately abandoned and stereos will be used exclusively by any essayist who desires to illustrate his root canal work."

That was written some eighteen months ago, and mark well those words tonight—just as soon as that *easy way* is found, no orthodontist will again rely entirely upon the plain skiagraph, for to none of us is the stereograph more valuable than to these self-same orthodontists.

Who would look at these pictures (Fig. 3) and imagine that they are of one and the same tooth and taken within five minutes of each other? And yet they are. This is a splendid example of what different shadows the same tooth will cast upon films when the pictures are taken from different angles, and yet a stereograph of this case locates the imbedded tooth clearly.

Again see Fig. 4 where two laterals are seen to be erupting. Here the plain skiagraph was absolutely valueless because of the superimposing of one root shadow over the other, so that they were indistinguishable, and yet a stereograph showed very clearly which was the supernumerary tooth and which was the permanent lateral.

The identification of the supernumerary tooth was based absolutely upon the evidence of this stereograph, and upon its extraction the post-mortem proved the diagnosis to be correct.

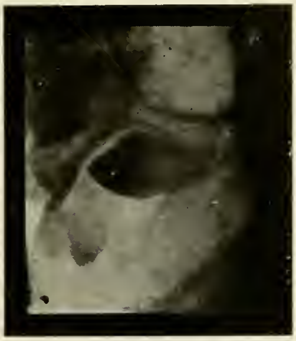

Fig. 5.

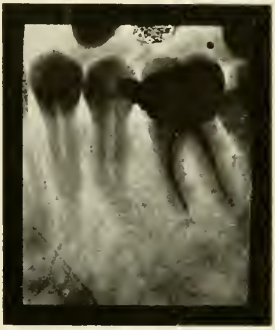

Fig. 6.

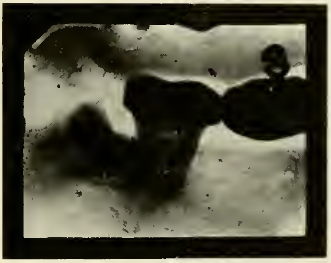

Fig. 7.

In Fig. 5 is shown an unerupted cuspid, which, in reality, was in no such position as this misleading shadow would lead us to believe.

After a careful study of the stereograph of the case, a lancet was run down upon the point of the cusp *as intended*—not missing it by a hair's breadth.

Here in Fig. 6 is shown a lower molar, with its three root canals filled. The filling protrudes slightly through the end of one canal. There are two ways of finding out from which canal the filling does protrude:

1—Extract the tooth and hold a post-mortem.

2—Stereograph the case.

Impacted Molars.

There are many cases of impacted third molars, both upper and lower, which absolutely cannot be diagnosed by an ordinary skiagraph, and yet a correct diagnosis is of vital interest to the patient.

In Fig. 7 is shown such a case. This patient was about thirty years of age, and there was no visible evidence of the third molar. She was a stranger and came to have her mouth put in order.

The bridge partly shown was naturally condemned on sight, greatly to her surprise, as she thought it was such a fine piece of work and had never given her any trouble, and a skiagraph was taken in order to reveal the possible miseries hidden below. The impacted molar was thereupon accidentally disclosed.

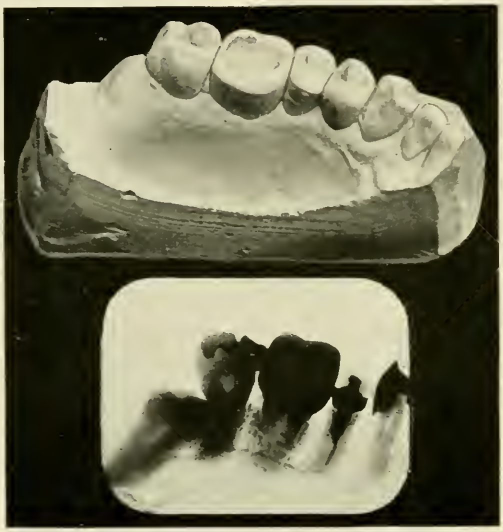

Fig. 8.

Then came a history of pain and suffering in the back of her head and neck, for which she had been treated and treated off and on for years, all of which was undoubtedly traceable to this tooth.

The whole course of treatment must be decided upon by the actual relative positions of the second and third molars. If the third molar had burrowed its way into the second molar, the second molar should be extracted, whereupon the third molar would eventually erupt and possibly become a useful member of the dental family.

But if the third molar lay either lingually or buccally to the second molar, then it, itself, should be removed.

There were two methods of discovering the actual conditions:

1—Cutting down upon and exposing the third molar—not such a pleasant pastime for the patient if the process should show the second molar must be removed, and

2—The stereograph.

In this case the stereograph was taken and it was shown that the two mesial cusps of the third molar *straddled* the buccal corner of the root of the second molar. The third molar was thereupon cut down upon and removed, and, as far as could be observed, the second molar root had not yet been injured.

In Fig. 8 is seen an upper impacted third molar, a stereograph of which would be invaluable.

Many other such cases could be cited, but these should suffice to prove conclusively the advantages of stereographs.

The Tube Carrier.

Upon taking up the work of making dental stereographs upon films within the mouth, the first obstacle to be met was that of the tube carrier, as there were none upon the market at that time that were suitable to me, and so one was improvised, only to be changed from time to time.

One of the tube carriers devised for this work is here for use tonight, and will be described as used.

Before going further it might be well to call your attention to the fact that as the demonstration proceeds, it will be but natural for you to think, "Why is this particular detail done as it is?" and, "Why is not that particular step taken differently?"

The facts are, gentlemen, that there are many ways of varying each and every detail, and they have been changed frequently during the past fifteen years. But this evening there will be shown only one of the ways in which rather satisfactory dental stereographs can be taken, and is the way in which they are taken now-a-days.

The Film.

The Eastman positive film is used for this work. It is ordered in the 4x5 size, which is well adapted to the purpose, as any size required for the case in hand can be cut from it.

Preparation of the Film.

We first cut two black paper patterns of just the size of the films to be used. We then cut two pieces of ordinary red dental rubber, just about one-eighth or one-sixteenth of an inch larger all around than the paper pattern, and we lay them on the black end of the preparation board. Next we cut two pieces of Doherty's No. 14 black dental rubber of the same size as the red rubber, and we lay them with the black paper patterns on the white end of the board. In the dark room

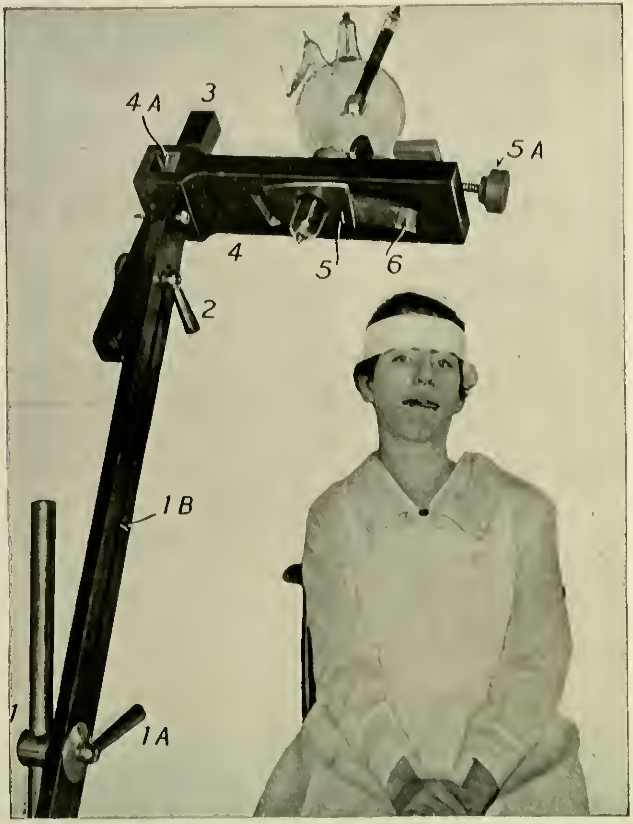

Fig. 9.

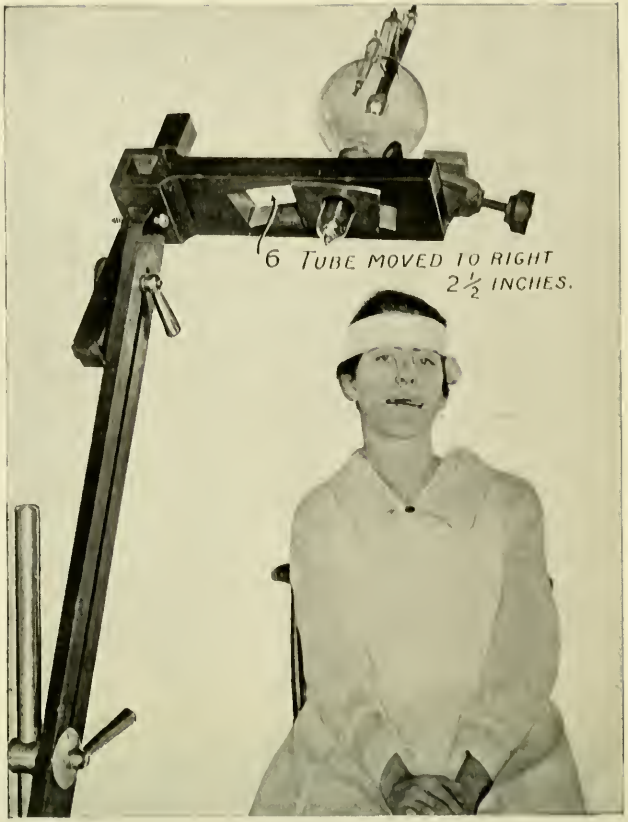

Fig. 10.

these various objects can be plainly seen against their contrasting backgrounds.

Four films are now cut exactly of the size of the paper pattern. One corner is clipped off from each of two films, so as to permit of their identification, and they are laid upon the red rubber, emulsion side up. The other two films are now laid, one over each of the first ones, emulsion side up. The black paper pattern is now placed over each film, and the piece of black rubber is placed over them. The edges of the red and black rubber are next pinched together with pliers, and we now have a waterproof, light-proof packet ready for use, the black rubber surface to be exposed toward the tube.

Identification Mark.

Upon one corner of the black rubber of one of the packets is placed a small metallic letter L, or some other identification mark, and the films are now ready for use.

Preparation of the Patient. (wiring of the teeth.)

In the early days it was frequently found difficult to register the two stereographs when trying to view them in the stereoscope. Placing of fine wires around two of the teeth upon opposite ends of the region to be stereographed before the picture was taken, was found usually to overcome this trouble.

This method is used when no fixed planes are used. When a fixed plane or a tunnel is used it is better to secure a fine brass wire in some suitable place on it instead of the teeth. The result is the same, and by doing so, the patient is spared the annoyance of the wires.

The Tunnel.

A tunnel as here shown is made of aluminum. Soft modeling compound is attached to its lateral edges and adjusted in position in the mouth, while the modeling compound is still soft. The teeth are closed gently into it, thus holding it firmly in place.

The films can now be slipped in and out of the tunnel without much danger of the patient's moving.

Adjustment of Tube. (for the upper jaw.)

The patient is now seated in a comfortable position and the head tightly bandaged to the head-rest. To use the usual expression, the tube is now "focussed" upon the center of the region to be taken. However, as the X-Rays cannot be "focussed," it would probably be more correct to use the word "centered."

In Fig. 9 is shown the stand used for taking stereographs and patient in position.

1 is a metal rod standing up in the center of the conventional tripod on rollers.

1 A is the clamp which secures the slotted upright (1 B) at any angle and allows it to be raised and lowered.

2 is another similar clamp, which in turn locks 3.

3 is a solid square wooden bar adjustable to any desired angle, and it slides up and down in the slot 1 B.

4 is a heavy section of wood fitted as shown to be the adjustable tube-carrier itself. It is shown slipped on to the square member 3.

4 A is another square hole standing at right angles to the first one. If the tube carrier 4 is secured to the square bar 3 by means of this hole, then we have the tube carried at right angles to the position here shown. It is in this latter position when taking stereographs of lower teeth. This double adjustment facilitates the taking of stereographs of various regions of the jaw.

5 is the sliding member which travels a distance of two and a half inches and supports the tube.

5 A is an ordinary tube clamp secured to 5, holds the tube firmly in position, and, of course, moves with it.

6 is a slot cut on a circle, so that when the tube is shifted, it travels along the segment of a circle.

The patient is shown with head bandaged to the head-rest—tunnel and films in place ready for the left eye exposure.

In Fig. 10 tube has been shifted along the path of the circle two and a half inches to the right, and all is now ready for the right eye exposure.

In practice, the tube would be placed nearer to the patient and at a little different angle. If the actual pose for this picture had been made, the various details would not have shown clearly in the picture, but the principle is just the same, as was demonstrated at the meeting, when a stereograph of the upper third molar region was satisfactorily taken.

Taking the Stereograph.

The proper adjustment of the tube having been accomplished, it is now shifted 1¼ inches to the left, the film bearing the letter L is slipped in position in the tunnel, and the tunnel placed in position in the mouth. The current is turned on, the exposure is made, and we now have the picture as seen from the left eye. The film is removed, its mate put in its place, the tube is shifted 2½ inches to the right, and the second exposure for the right eye is made. Care should be observed that both films are exposed equally. It is possible to take these stereographs by having the films held between the teeth without the use of the tunnel, and many have been made in that manner.

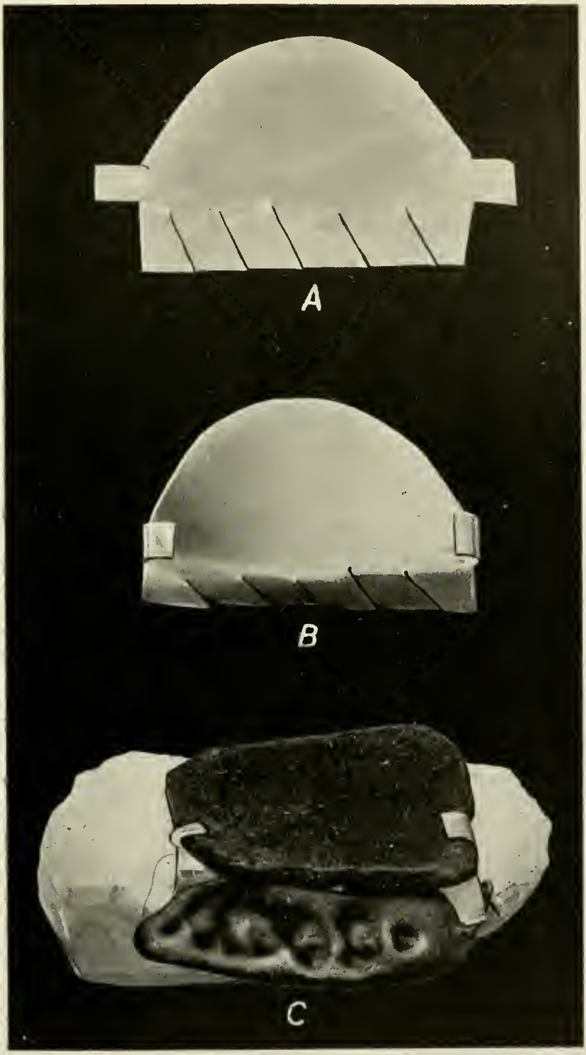

Fig. 11.

Any region in the upper jaw can be stereographed with the films placed between the teeth in this manner, but when it comes to a region in the lower jaw, we meet a different proposition.

Remembering that both films must be held upon the same plane, the method here used is as follows:

The Film Holder.
(for the lower jaw.)

In Figure 11 is shown the various steps for making a guide plane for taking stereographs of teeth in the lower jaw.

A. A piece of aluminum plate, No. 30, B. & S., is cut to this pattern.

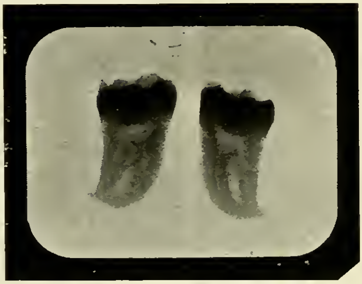

Fig. 12.

B. The slotted edge is then turned over to about a right angle and the lugs at each end bent over—all as shown.

C. The slotted edge is then slightly warmed over a Bunsen flame and a piece of softened modeling compound is attached to it. This is placed in the mouth, plane surface pressed against the inner surface of the jaw and held there while the compound is moulded over the crowns of the teeth. The patient then closes down carefully upon it—mouth opened—the plane again adjusted in place in case it had moved away during the occlusion. It is then cooled by means of a jet of cold filtered compressed air or a spray, and then removed. The finished plane in position on a model is here shown.

The films inclosed in black rubber, as previously described, have been clamped in place by the little lugs at each end.

The film holder is now placed in position in the mouth, the teeth closed gently against it so as to be assured it goes to place, and the exposure made. The plane is then removed, film taken off, another one put on, the holder returned to the mouth, where it must be replaced to its exact former position, which is readily done, and the second film is thus held on the same plane as was the first, and the exposure made.

With the patient placed in a comparatively comfortable position, so that she can sit immovably during the process, and care being used to carry out these details without the loss of any unnecessary time, perfectly satisfactory stereographs can be thus obtained of teeth of the lower jaw.

Developing the Film. We now have two pairs of exposed films, and it is well to develop one pair first, using the utmost care to bring them to the same density, and the two pairs can be identified afterward by the one being clipped and the other not.

The Stereograph. Each finished film is now placed between two pieces of glass of a suitable size and the edges bound with gummed paper, which renders them substantial, keeps them flat, and facilitates easy handling. They are then placed upon the top of the stereoscopic box, by means of which they are trans-illuminated. While adjusting the focus of the lens the films are carefully moved about until they register, at which instant their beauties burst forth.

By means of this stereoscope, a practical examination can be made in a very few moments after the films are dried, but one not accustomed to its use finds it rather awkward and unsatisfactory, and it is not a very good apparatus for exhibiting one's work to others.

To overcome these drawbacks, the stereoscope now shown was devised. The two films are first secured to a piece of glass in their proper relative positions and photographed on a plate. From this plate a transparency is made which fits this stereoscope.

This transparency can be quickly adjusted and viewed with satisfaction in any parlor stereoscope by any one, but the special stereoscope here shown shows it to better advantage, as all side light is cut out.

Mounting the Films. If the films are of just the right density, they may be properly placed upon a sheet of glass by means of gummed paper strips. All the rest of the plain glass is also covered with this same paper, and quite a satisfactory transparency results.

Making Prints. It is possible, of course, to make the usual prints from the films and place these upon mounts to fit an ordinary parlor stereoscope, but so much of the beauties of the original films are lost in the process that one hardly has the heart to spoil his work in this manner.

Reversing the Films. There is a most wonderful feature about this work. If the left eye picture is placed on the left, and right picture on the right of the stereoscopic box, upon looking at them it will be found that we are looking through the jaw from the same direction that the rays were thrown. In this case, for instance, with the picture so placed, we appear to look down through the buccal plate, through the alveolar process, and so on. Everything appears just in these relative positions. As a matter of fact, these pictures present a *buccal aspect* of the case.

But let us reverse the pictures, placing the right eye picture on the left and the left eye picture on the right, and a most wonderful transformation has taken place, for now we are looking through the jaw from a position within the mouth and now they present an actual *lingual aspect.* Strangest of all is the fact that viewing pictures in this direction is the most satisfactory of the two, so that the pictures are always reversed for reading.

The Lingual Aspect.

Mr. Chairman, did you, Sir, ever go up to a fine old bull in the middle of a forty-acre lot, with not a tree in sight, and shake a red flag in his face? No? Well, of course not. That certainly was a foolish question, because if you had done so, you would not be here this evening listening to this intellectual feast.

Well, at any rate, you well know that the bull's feelings would have been somewhat ruffled at such a performance, and that is just what happens to me when a patient comes in, and produces a lot of *dental radiographs* labeled "Lingual Aspect" for my inspection.

We will now study two views of the same tooth (Fig. 12). The one is a "lingual aspect," according to the aforesaid *radiographers,* and the other, therefore, must be a "buccal aspect," as it is the reverse of the first.

Is there any one present who can tell which is which? Undoubtedly not, because both being merely skiagraphs, there is no appreciable difference between them.

Evidently there is a small filling in the tooth, and it could be on the buccal surface, or it could be on the lingual surface. Who is there here who will scrutinize these pictures carefully and venture an opinion as to which surface the filling really is upon? I hope some one who does this "lingual aspect" work will have the nerve to try.

Now, Mr. Chairman, the term "lingual aspect," as applied to a plain skiagraph, must be incorrect, and let us hope that all those who have used the term heretofore will discontinue its use in the future. It is certainly a reflection upon a man's standing to have such a misnomer accompany his work, and unless he can differentiate between this buccal and lingual aspect of the tooth shown in Fig. 12, misnomer it must be.

However, to a stereograph there certainly are both lingual and buccal aspects, according to how you view them, as has already been explained, and there is no camouflage about that feature, as they are readily distinguishable from one another.

It is suggested that if your purely shadow pictures must have a label, that the words "buccal exposure" be used instead of "lingual aspect." By buccal exposure is meant that the buccal surface was exposed *directly* to the rays, and conversely, "lingual exposure," that the lingual surface was directly exposed.

The word *directly* is used with a purpose, as both surfaces are actually exposed to the rays as the rays pass through the tooth.

It would naturally appear that such terms, equally as distinctive, could be applied to nearly all parts of the body. Instead of saying that a skiagraph was taken *antero-posteriorly*, it would only be necessary to say *frontal exposure*. "Palmar exposure" of the hand would clearly and concisely indicate which surface of the hand lay against the plate, and so on.

A very great drawback to stereoscopic work is that it cannot be shown upon a screen and thus be visible to an audience. Each stereograph must be viewed in the stereoscope by one person at a time.

(Dr. Kells here made a clinical demonstration of making stereographs.)

Mr. President and gentlemen, you have now seen the whole process of making dental stereographs upon films within the mouth, as practiced by your essayist. You will note that, as compared to the taking of plain skiagraphs, the process is tedious and difficult, but bear in mind that when a case presents of which the plain skiagraph spells failure, and the stereograph means success, there can be no such words as "tedious" and "difficult"; the ends attained make the work a pleasure and the satisfaction of changing failure into success should allow the easy road to failure to be overrun with weeds, while the more difficult path to success is being beaten down to hardpan.

If what has been shown this evening has proven of interest to the members of this Society, your essayist will have been amply repaid for the efforts made.

Discussion of Dr. Kells's Paper.

Dr. R. Ottolengui,
New York City.

I wish to take this opportunity to discuss the terminology which Dr. Kells has used in his paper this evening. In the first place, I will begin with the Roentgen part of it. Dr. Kells cited the fact that these pictures were first called skiagraphs and radiographs. Then he told us that when the American Society of Roentgenology was formed they coined a set of terms beginning with Roentgen, and he claimed that this society had a right to do that. That will be my first dispute with him.

If any one should ask me what my chief occupations are, I should say that I am an amateur photographer, an amateur philologist, an amateur orthodontist, and a professional dentist; professional at least in the sense that I profess a good deal. (Laughter.)

I want to speak to you now from the two standpoints of an amateur philologist and an amateur photographer, and first as a philologist. I became a member of the Section on Philology in the Brooklyn Institute long before Roentgen discovered the X-ray. Consequently, I may say that the rules for coining words existed long before Roentgen discovered the X-ray, and therefore long before the American Society of Roentgenology was organized. In the realm of science one scientific society has no right to break the rules previously and correctly established by another scientific society.

In philology, which means a love of words, there are definite rules for making new words, and one of the most rigid of these rules is that in coining a word you cannot combine from two languages, with few rare exceptions, where Latin and Greek may be used together, largely because in the Latin and Greek there are a number of words in common. But even this is undesirable and should be avoided if possible.

Another rule is that one must not coin a word out of a proper name. That, however, is largely a matter of taste more than a set rule. Philology tells us not to combine two languages to make one word and not to coin a word out of a proper name. Such a word as "Roentgenology" breaks both rules, because *logos* is from the Greek and Roentgen is a German word and a proper name. So much for Roentgenology.

When Dr. Kells tells us that the Roentgen Society had the right to create all these Roentgen terms, I am forced to disagree with him. The Roentgen Society could with propriety honor Roentgen by dropping the term X-ray and calling it the "Roentgen-ray," but there they should stop.

Skiagraph.

Let us now discuss this word "skiagraph." Dr. Kells tells us that "skiagraph" is from the Greek, means "shadow picture," and "these are shadow pictures and nothing else."

This word skiagraph, from *"skia,"* shadow, and *"grapho,"* to write. was in the dictionaries before the Roentgen-ray was discovered, and probably was originally coined for use in its astronomical sense, in which science it means to "determine the time of day by means of a shadow." Literally, to "write (the time) with a shadow." In the early days of the use of the Roentgen-ray it was used to mean these pictures taken with the Roentgen-ray, and for this reason I have no doubt that it can be found in dictionaries of today defined just as Dr. Kells has defined it. Nevertheless, I contend that the more recent term "radiograph" is a better term, for which reason "skiagraph" should fall into disuse.

Let us question Dr. Kells's statement for a moment. Is the picture under discussion a "shadow picture"? I think not.

A shadow is a darker area cast upon an illuminated surface by the interposition of an opaque body between that surface and the source of light. But more than that is to be considered. The quality of the surface upon which the shadow falls is a factor in producing the shadow. It must be an opaque surface. Shadows are not seen upon transparent surfaces. Is a photographic film opaque? If it were and if these pictures were "skiagraphs," shadow pictures, we could make only one at a time. Yet we know that we can make ten as easily as one.

A shadow is almost if not entirely of one shade. And, what is more important, the gradation of the shadow does not depend upon the so-called "density" of the object, but upon the distance between the object and the surface which records the shadow. Try a simple experiment. Hold a wooden ruler between an electric light and a white wall. Move the ruler slowly away from the light and toward the wall, and observe that the shadow increases in its intensity as it approaches the wall. Certainly, its molecular arrangement is not altered.

To be scientifically accurate, we could make the following differentiations: A photograph is produced by the action of light reflected from an object, through a lense, upon a sensitized plate. A radiograph is produced by the action of the Roentgen-ray passing through an object and affecting a sensitized plate. A skiagraph is produced by interposing an opaque body between the source of light and an illuminated opaque surface, which thus records the shadow cast.

Hence I would be willing to have Dr. Kells use the term skiagraph for a Roentgen-ray picture of a gold crown or other object composed of material which is radiopaque. But those pictures used by him to demonstrate his views on "lingual and buccal aspects" are true radiographs because the internal anatomy of the tooth is disclosed.

I hope that I have finally convinced Dr. Kells of the error he makes in adhering to this word "skiagraph," but I fear not, because I have frequently written several pages to Dr. Kells trying to convince him in certain matters, and in reply I usually have received merely a sort of telegraphic form-letter reading: "Dear Otto,—You are wrong. Kells." (Laughter.)

Dr. Kells, (closing.)

I ought not to be held responsible for the vagaries of mind and odd ideas in Rod's head. (Laughter.) It is not my fault if he writes four or five pages of argument and I find he is wrong. We are friends and always have been. Is it not a great deal better to write him back, "You are wrong," than to write four or five pages and argue with him and let him think he is right? He might misinterpret what I said. (Laughter.) If I had known that Dr. Ottolengui was going to criticise my terms, I would have skipped that part of the paper in reading it, because I frankly confess that I am not in it on an argument with Dr. Ottolengui on anything. I never saw another man who could take absolutely nothing, the worst end of an argument, and build up such a fine argument and make everybody believe that he is right except the fellow he is arguing with or against. (Laughter.) He may tell us all that he chooses, on nomenclature and philology, but, nevertheless, this time he is wrong.

A skiagraph is certainly not a photograph. It is a series of shadows.

It does seem to me that a society of orthodontists ought to be free to coin the words necessary in their literature which pertains to orthodontia.

When it comes to X-ray work, if there is a national society composed of men who do X-ray work, it seems to me it is within their province and it is their privilege (I may be wrong about this), to make a terminology for themselves. I do not believe that outsiders should do it.

I am sorry that the only thing that really interested you this evening has been terminology. I came nine hundred miles since yesterday morning to present this subject, which I thought would interest you, but it looks as though I am to be disappointed.

I threw on the screen this evening a double picture and I said, "Who is there here who would believe that these two pictures were one and the same tooth?" I did not intend to tell this, but I am going to do so because it may have some weight. That was the picture of a little girl eight or ten years of age, and that stereoscopic picture was taken eight or ten years ago. I was then regulating teeth. Her father brought her to me and wanted me to do the work. I took pictures and expected to do the work, and before I started the work he wanted me to guarantee to bring the tooth down. I said certainly not. I told him I would guarantee to do my best, but I would not guarantee to bring the tooth down. I did not get the work. He took the girl to a capable orthodontist who guaranteed to bring the tooth down. This man worked on her four years, and at the end of the fourth year the tooth was not in sight, and he went in and cut the tooth out. That patient is wearing an artificial substitute today. If that man had had stereographs of that case from time to time and worked with them, I believe he would have got that tooth down.

I showed another picture of the case of a little girl that was brought to me a few months ago. The tooth was nowhere where a plain skiagraph showed. I took a stereograph. I cut under the cusp, and that tooth will be brought down and in line.

I have had cases in my practice that would have been failures without the stereograph.

Dr. Flint. By taking pictures at two different angles, can you locate a cuspid that is impacted?

Dr. Kells. With a plain skiagraphic picture I do not say that it canont be done, but I know I cannot do it. Take the case of which I showed two pictures; neither one of those pictures was worth a cent. I am referring to the little girl with the two upper laterals (Fig. 4). You could not make a diagnosis from a skiagraph because the roots overlapped. We could differentiate, however, with the stereograph. Just imagine a beautiful little girl, eight years of age! What a mistake it would have been to have extracted that permanent lateral, leaving in an inferior or constricted supernumerary tooth. She would have been marked for life.

No one can appreciate the importance of this work until he studies it, but if you examine a stereograph you are not looking at simple shadows. Take a stereograph of the skull and you will find it is wonderfully beautiful. You see the various bones clearly. You see the teeth floating, as it were, looking semi-transparent. You can see these light grayish objects that are more or less distinctly defined. The teeth are well defined. The hard bones around the sinuses are well defined.

Lastly, I wish to thank you for the marked attention you have given to me in presenting this subject. (Applause.)

The Removable Lingual Arch as an Appliance for the Treatment of Malocclusion of the Teeth.

By Dr. John V. Mershon, Philadelphia, Penna.

It is a well-known biological fact that to have normal development of the tissues and organs of the body, we must have normal function of those tissues and organs during the process of development.

Anything interfering with the forces which produce these functions will interfere with the functions, and just in proportion as we have a disturbance of function we will have a disturbance in development.

Malocclusion of the teeth or maldevelopment of the facial bones is quite likely the result of a perversion of or some interference with these functional forces, and the orthodontist is endeavoring to correct these deformities and restore these functional forces with orthodontic appliances. These appliances are effective just in proportion as they apply force in the direction of normal growth, and in so doing do not interfere with the functions of any of the tissues associated with the teeth, or with the teeth themselves collectively or individually, each tooth being left free to functionate normally.

The direction of normal growth of the teeth and facial bones are, forward, outward and downward in the upper jaw: forward, outward and upward in the lower jaw.

The appliance, in which the application of force is in these directions and which does not interfere with any of the associated functional forces, would be the ideal appliance. I ask your consideration of the removable lingual arch as the appliance which seems to possess many of these qualities.

Occupying a position on the lingual surface of the teeth and at the gingival border, with all the teeth free to functionate normally (except the two molar teeth to which the arch is attached), the appliance develops a force which operates from the lingual side and is in the direction of normal growth, and the muscles of the lips and cheeks are left free to functionate normally.

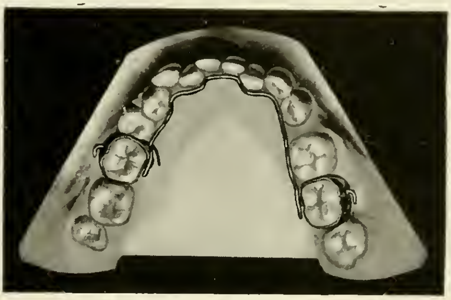

Fig. 1. Lingual arch bent to conform to the lingual surfaces of the teeth.

The Arch.

The removable lingual arch is a wire of suitable size, to which auxiliary springs can be attached, adapted to the linguo-gingival surface of the teeth, and bent to conform to all the inequalities of the dental arch (Fig. 1), produced by the irregularities of the teeth. It is fastened to the lingual surfaces of the molar bands by means of the Young-Angle lock, with certain modifications. This lock has proved most valuable to the profession, and we are greatly indebted to the developers of it. I have modified it by using a half-round tube in place of the elliptical one. The lock is a wire soldered mesially of the tube, instead of being formed by bending the portion of the arch which is distal to the tube to engage it gingivally.

Construction of the Arch.

The arch is constructed on a plaster model made from a good impression, bands having been previously fitted to the anchor teeth (usually the first molars). These bands are transferred to the corresponding teeth on the plaster model, with half-round tubes soldered at the proper location on their lingual surfaces.

Bending the Arch Wire.

We start at the half-round tube, allowing the arch wire to extend about one-eighth of an inch, distally beyond the tube. Just mesially of the tube we make a compound bend in the wire, first to the gingiva, then again bending the wire parallel with the gingiva, and continuing along the lingual surfaces of the teeth, as close to the gingiva as possible, without impinging on the same, adapting the wire to all the irregularities of the dental arch, until the tube is reached on the anchor band on the opposite side, when the arch is cut off one-eighth of an inch distal to the tube.

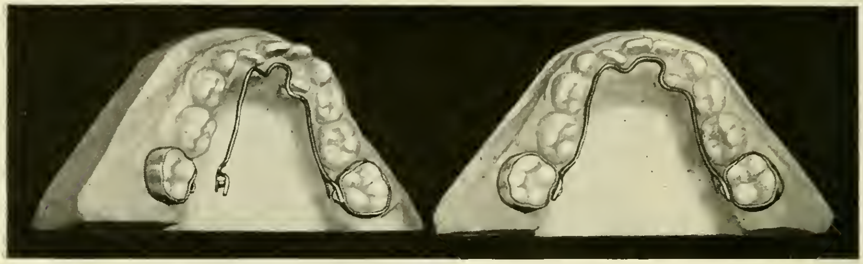
Fig. 2. Fig. 3.

Fig. 2. Trying in the arch, showing incorrect position.
Fig. 3. Trying in the arch, showing correct position.

Location of Half Round Tubes on Molar Bands.

The tubes should be placed on the lingual surface of the anchor bands, usually in the center of the band mesio-distally in both upper and lower jaws. In the lower they should be placed as near the occlusal edge of the band as possible, allowing only sufficient distance between the occlusal edge of the band and the top of the tube, for the arch. This is so placed for the reason that the post is easier to place in the tube if it is not too far toward the gingiva, as it is difficult to see the tube in the lower on account of the tongue and saliva. In the upper jaw, the tube should occupy the same position mesio-distally, but should be placed as near the gingiva as possible, otherwise the lingual cusps of the lower molars will come in contact with the arch, and the continuous biting on it will eventually cause the arch to break.

Soldering of the Half-Round Post.

The post consists of a half-round wire soldered to the arch and accurately fitting the half-round tubes forming a portion of the lock.

For convenience in soldering, a long piece of half-round wire is selected.

Place the arch accurately on the model, mark the arch opposite the tubes, then solder the post to the arch opposite the mark, in the usual free-hand manner, cutting off the half-round wire just a little shorter than the tube, leaving a catch for the lock wire. Then place the half-round post wire in the tube on the molar bands on the model. If the arch should not lie correctly on the model, remove it, and with two pair of the Young pliers it can be twisted to the desired position. Proceed in the same manner for soldering the half-round post wire on the

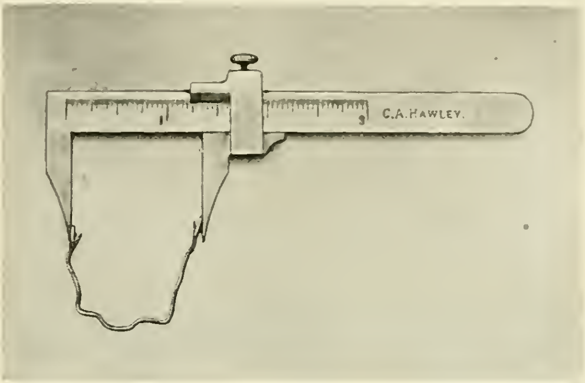

Fig. 4. Illustrating method of measuring with Hawley Calipers.

opposite side. The arch is again replaced on the model with both pieces of the half-round post wire in the tubes. If the arch should not be well adapted or be raised away from the model, direct the flame of the blow pipe on the arch, heating it to a cherry red, and while hot, press with a suitable instrument on the arch, by which means it can be readily adapted to the model.

The lock consists of a wire of suitable size, soldered to the gingival surface of the arch, twenty-one hundredths of an inch mesial to the half-round post, passing it distally to catch under the gingival surface of the tube, thereby preventing the post coming out of the tube. After polishing, the arch is now ready to place in the mouth. Remove the anchor bands from the plaster model and cement them on the teeth. In trying the arch in the mouth, grasp the arch on the left side, in the region of the half-round post, with a pair of Howe pliers, and place the post in the tube on the left side. The arch should lie in its proper position, with the half-round post on the opposite side, parallel with the half-round tube. Should it not, twist or bend arch until it lies correctly (Fig. 2). Remove the post from the tube on the left side, then place the right side post in the tube. If your post on the left side drops in place with the tube, then your arch is ready to be locked in place (Fig. 3).

Material and Sizes.

The size of the wire for the arch which has proved most satisfactory is thirty-six one thousandths, nineteen gauge B. & S. For the lock, twenty-six one thousandths is used. The half-round tubes are ten one hundredths of an inch long, and the post wire sixty-four one thousandths by thirty-two one thousandths.

The arch wire should be hard, with a good spring, and sufficiently tough to stand bending and rebending, also to stand stretching with the pinching pliers without breaking. It should also possess the quality of softening by annealing, and retempering again, and should be sufficiently high fusing to stand soldering with a high carat solder. Some of the gold and platinum alloys on the market today possess all these qualities. The half-round tubes, the post wire, and the wire for the auxiliary springs, are all of the same material as the arch itself.

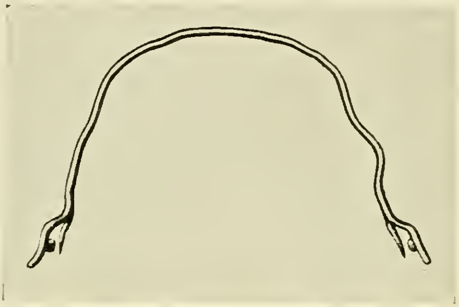

Fig. 5. Showing arch after kinks had been taken out. Same arch as in Fig. 1, with bends taken out.

The Auxiliary Spring.

These springs are wires usually twenty-two one thousandths of an inch, soldered to the main arch wire to produce individual tooth movement.

Proper Location of the Arch.

The arch should occupy a position on the lingual surface of the teeth as close to the gingiva as possible, and made to conform to all the inequalities produced by malocclusion.

The Use of the Arch.

I shall only consider treatment in so far as it consists of general arch development, and tooth movement in the individual arches.

The arch when first placed in the mouth should be passive, the patient being allowed to wear it long enough to become entirely accustomed to it—usually a week.

During this period children are more likely to play with the arch with the tongue or fingers than thereafter. Therefore, very strict caution should be given both patient and parent regarding this evil, as well as against sticky candy. After these precautions I seldom have trouble, but should I have, at the next visit I wire the arch with a fine ligature wire to some favorable tooth, and this usually cures the trouble after the patient becomes accustomed to the arch. I seldom find it necessary to band teeth for this purpose.

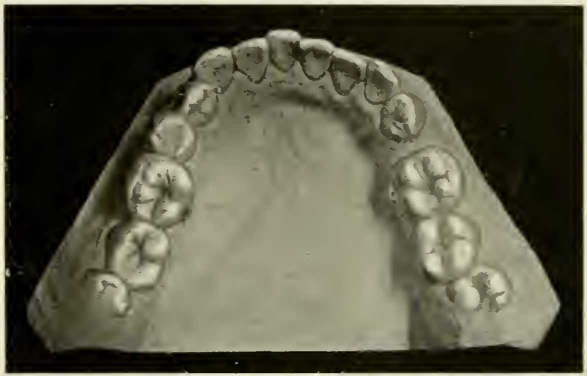

Fig. 6. Same model as Fig. 1 after 15 months' treatment.

Treatment.

The force necessary to produce tooth movement with the lingual arch is obtained in three ways. One, by straightening out the inequalities in the arch wire; another, by auxiliary springs soldered to the main arch; a third, by stretching the wire by means of the wire stretching pliers.

After removing the arch from the mouth, the procedure of adjusting it consists in taking a measurement of the arch from one post to the other (Fig. 4). This is most important, and is best accomplished by a pair of measuring calipers, such as Dr. Hawley used with his charts.

After this is done, retain the calipers for measuring before replacing the arch. I have above stated, the arch must conform to all the inequalities produced by the irregularities of the teeth, which necessitates a great many bends and curves in its length. We now proceed to take some of the bends and curves out of the arch (Fig. 5). This is best accomplished with a suitable pair of flat-nosed pliers. Each time you remove one of the bends or curves, the size of the arch is increased. When you replace the arch, by placing the posts in the half-round tubes there is a general forward and outward pressure on all the teeth that

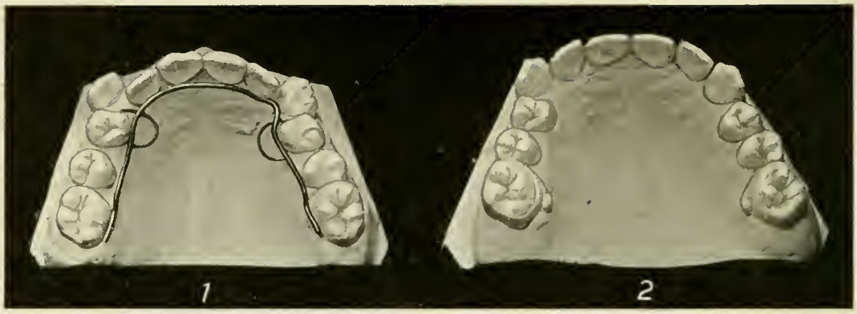

Fig. 7. Spring method of rotating upper first bicuspids. 1. Showing springs in position. 2. Showing results of two treatments.

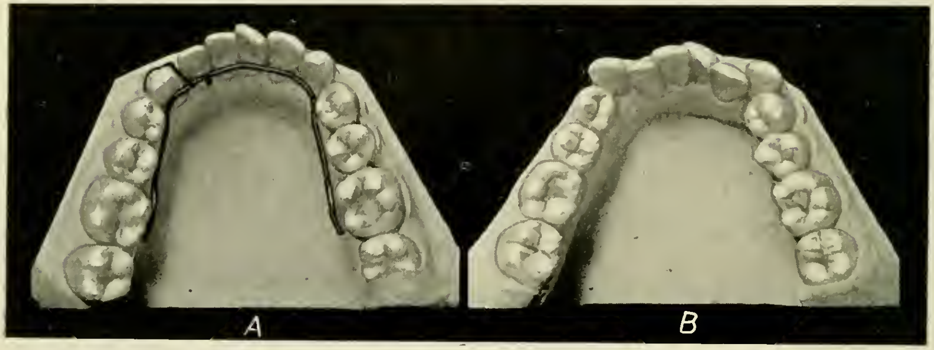

Fig. 8. Showing rotation of cuspid without bands by the use of auxiliary springs. A. Original model. B. Showing cuspid rotated.

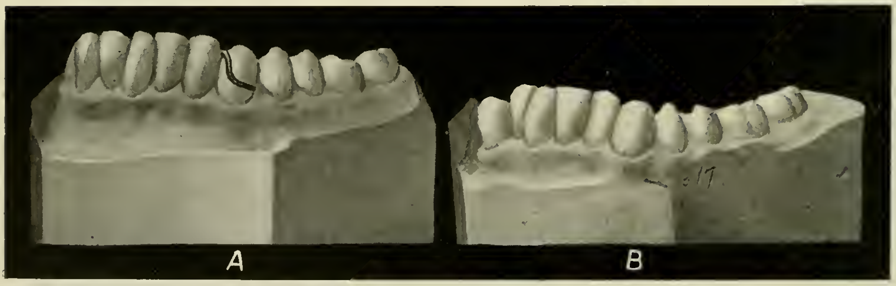

Fig. 9. Front view of Fig. 8.

require moving outward or forward (Fig. 6.) Your object at each treatment is to conform the lingual arch more nearly to the shape you expect the dental arch to be when completed. It is astonishing how little change is required at each treatment. As you straighten out a curve which was toward the lingual to conform to a tooth that was lingually placed, on replacing the arch, the most pressure naturally comes on that tooth, and it is in this way that we obtain an outward pressure. After making the adjustment in the arch, before replacing it in the mouth, always measure across from one post to the other with the calipers with which you have previously measured, noting that you have made no change in this region, unless you wish expansion of the molars. After making this change in the arch, it is interesting to note that when replaced in the mouth and locked into position, the arch will push a little harder on the teeth you wish to move into the line of occlusion with a beautiful reciprocal force. Continue in this manner from time to time, either broadening or lengthening the arch or both as desired, until the teeth have been moved to their desired position.

Auxiliary Springs. These springs are usually soldered to the gingival side and at right angles to the main arch, and are then bent in the direction in which you wish to apply force. The reason for soldering the springs at right angles to the arch and bending them is, that in soldering, the high heat removes the temper from the wire, while the bending to correct position restores the spring temper. The general developing and shaping of the dental arch is best accomplished by the reshaping of the main arch.

Individual tooth movement is best accomplished by the individual springs.

Rotations. For rotation without banding the teeth, let us take as an example the upper first bicuspid, which frequently erupts with the lingual cusp rotated mesially (Fig. 7). This is very easily corrected by soldering a spring to the main arch, opposite the approximal space between the first and second bicuspid. Bend the wire mesially, forming a half-circle, with the free end of the spring wire engaging the first bicuspid, with pressure on the mesial surface opposite the lingual cusp.

The spring wires are quite long and you can give a good deal of spring to them. On account of the small gauge of the wire it will be a very gentle force, effective for a long period of time, often as much as two months.

Rotated cuspids can in many cases be corrected without banding the teeth. Allow the lingual arch to rest with slight pressure against that

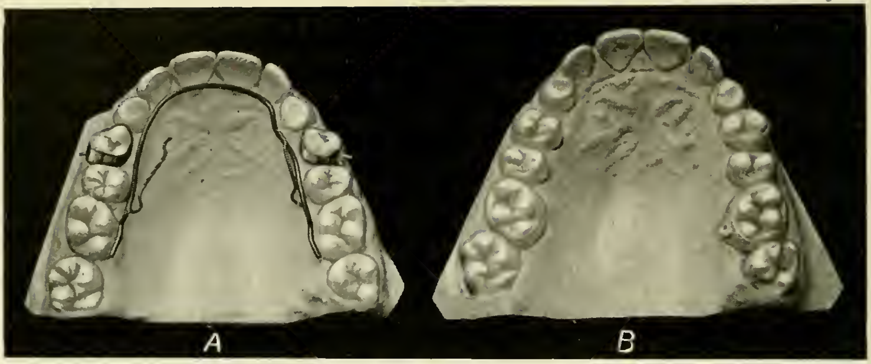

Fig. 10. A. Showing auxiliary springs for rotations when a case can be seen infrequently. B. Showing result after being wired once and allowed to remain a number of months.

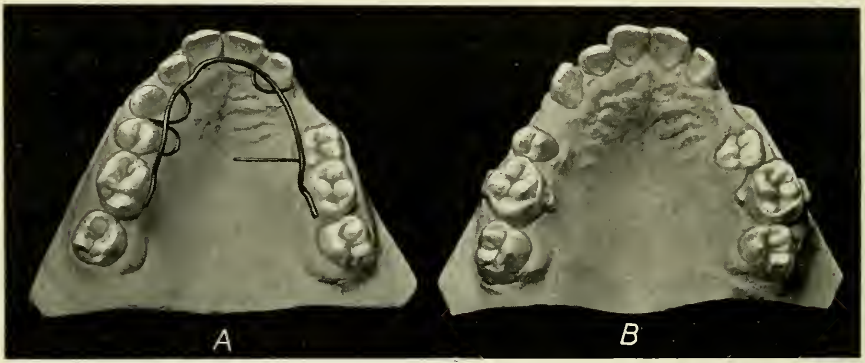

Fig. 11. Method of opening spaces with auxiliary spring. A. Showing spring in place, with the straight one showing how they should be soldered before bending. B. Showing result of treatment.

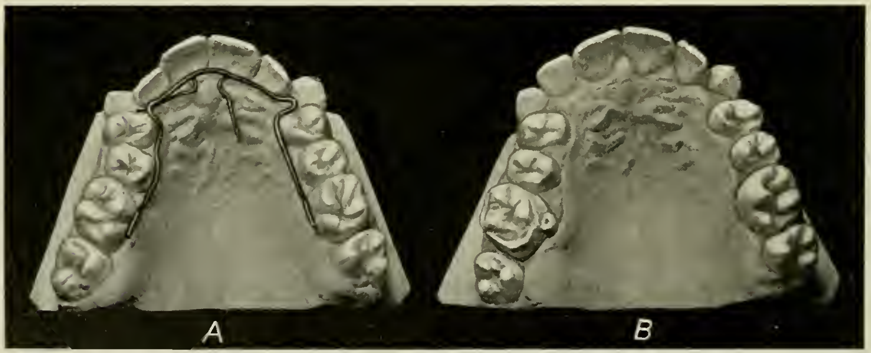

Fig. 12. A. Showing auxiliary springs for labial movement of laterals, one in correct position, the other just before bending in correct position. B. Showing result of treatment.

angle of the tooth which is rotated toward the lingual (Fig. 8). At this point solder a wire spring pointing occlusally, bending the spring wire labially to pass between the cuspid and the adjoining tooth, and continue the bending toward the gingiva, allowing the loose end of the wire, which has been properly shaped therefor, to engage with pressure the labial portion of the cuspid, which is rotated labially.

A large proportion of such rotations can be corrected in this way (Fig. 9).

A method employed where the case can be seen infrequently is to band the tooth to be rotated in the usual way, with a spur attached to the labial side of the band (Fig. 10). With a spring wire of twenty-six one thousandths soldered to the arch some distance from the tooth to be rotated, bend the spring almost parallel with the main arch. On the loose end, which should now stand some distance from the arch, place a fine ligature wire, which, passing through the gingival space, engages the spur on the band. After this the ligature wire should be tightened until the spring is in contact with the main arch. It is well to make a bend at the end of the spring wire, so that the ligature will not slip off. The tendency of the spring wire to return to its original position will cause the tooth to turn on its axis.

Anterior Rotations.

To rotate central and lateral incisor teeth, use a grass line by ligating the tooth, then passing one end around the arch and back through the gingival space, tieing the two ends firmly together. The contraction of the grass line will cause the tooth to turn. In younger cases the lingual arch will frequently correct a rotation of the anterior teeth, simply from the light pressure of the arch resting on the corner of the tooth rotated lingually.

The lips being free to functionate, are pressing on the labial portion of the same tooth and are assisting in correcting the rotation.

Rotation of the First Molars or Anchor Teeth.

Of all the teeth, the correct rotation of the first molars I consider the most important. When they are used as the anchor teeth, this is easily accomplished by making a very slight bend in the arch wire where the half-round post is attached. The molar roots or crowns can also be tipped buccally or lingually by grasping the arch mesial to the post with a pair of Young pliers. At the same time, with another pair of pliers, grasp the arch where the post is soldered to the arch, giving a very slight twist in the direction you wish the movement, caution always being taken that you do this exceedingly slowly; otherwise you may cause your anchor teeth to loosen. This precaution should be taken at all times in using the lingual arch, as it is very easy to place great strain on the anchor teeth. To overcome this it is wise to solder a spur on the arch to engage the mesial surface of the first bicuspid. This greatly relieves the strain on the molars, as you can increase or diminish the pressure of the spur at will.

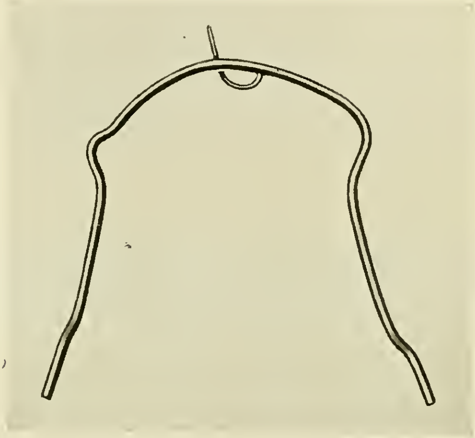

Fig. 13. For mesial or distal movement of anterior teeth.

To Open Space for Impacted Teeth or Missing Teeth.

This is accomplished by two auxiliary springs, soldered to the arch, one the width of a tooth distal to the place you wish the space, the other the width of a tooth mesial to the space, making the two springs the width of two teeth apart. The one most distal curves mesially to engage the one tooth, while the mesial one curves distally to engage the other tooth (Fig. 11).

The spring should always be soldered at right angles to the arch before bending into the half-circle.

With the loose end of the spring flattened by disking the sides, this end usually passes to the gingival side of the arch to engage the teeth.

Labial Movement of Teeth.

To move laterals labially a spring is soldered to the arch, opposite the median line, then bent to the right or left to engage with pressure the lingual surface of the lateral that is to be moved (Fig 12). To move the anterior teeth mesially or distally, solder a spring to the arch about fifteen one hundredths of an inch distal to the tooth to be moved (Fig. 13). Bend the spring in a curve, passing the loose end.

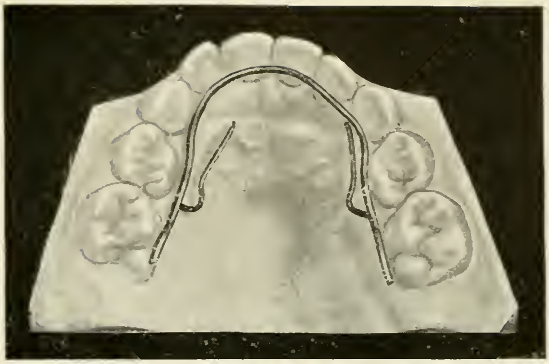

Fig. 14. Auxiliary springs for lateral development in deciduous denture.

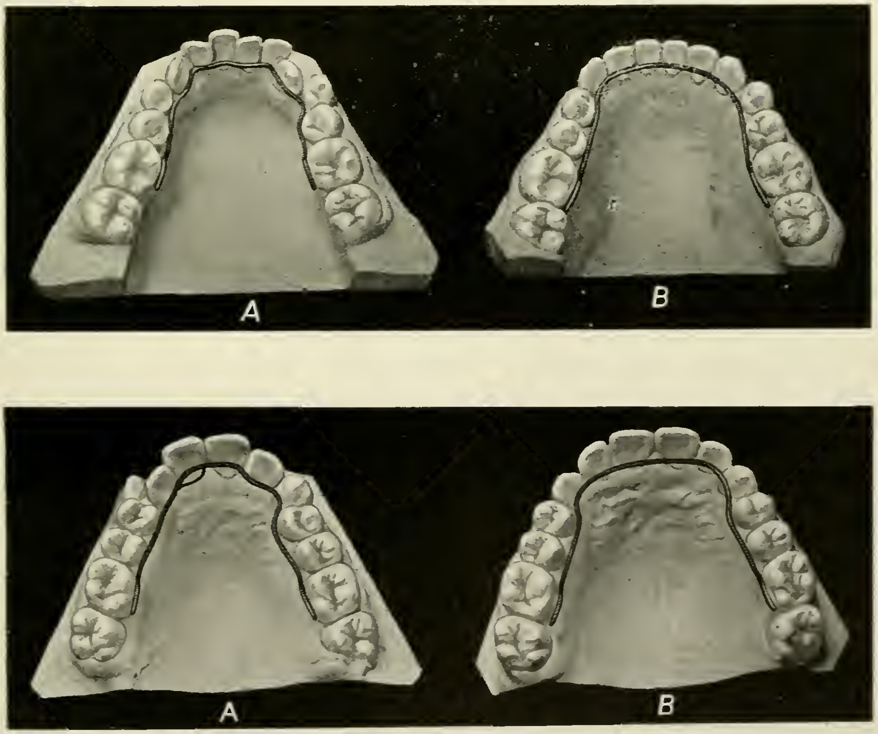

Fig. 15. Showing case before and after treatment. A. Original model. B. Same mode and arch after treatment.

which should always be flattened by disking both sides until it is very thin, to the gingival side of the arch, and if properly adjusted (this is most important in all of the auxiliary springs) it will pass between the tooth and the soft tissues at the gingival space in the same manner as a thin band. Tooth movement is very easily accomplished if slight pressure is applied to the tooth by tightening the spring from time to time.

The auxiliary spring is very useful with the deciduous denture where we are desirous of obtaining lateral development from one deciduous cuspid to the one on the opposite side (Fig. 14). Adapt the arch to the lingual surfaces of the teeth, soldering springs on both sides to the gingival side of the arch, as near the lock as possible. Bend each spring wire parallel with the arch to engage the deciduous cuspid by flattening the end of the spring and bending it toward the gingiva to fit around the basilar ridge of the tooth. With the proper adjustment of the springs the desired development can be obtained.

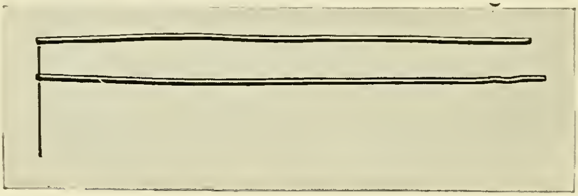

Fig. 16. Arch wire in case in Fig. 15. Lowers straightened out, showing difference in length of wire from distal surface of first molar on the completed case, and the case when started, showing how much is gained in length by straightening out the loops.

One very interesting feature of the lingual arch is that in moving teeth you seldom have tipping of the teeth, and when you do it is very slight; that is, unless you have been unwise and hurry your work faster than normal development.

The reason the teeth do not tip is probably because the arch occupies a position to the lingual of the teeth at the gingiva, pressing forward or outward, or both, as you desire, with the lips and cheek muscles left free to functionate normally, and every contraction of these muscles causes pressure on the incisal edges of the teeth. Every tooth left free to receive the normal occlusal impact during mastication produces a normal functional bone development, causing the teeth to be carried bodily forward.

In a great many cases the amount of wire from one-half round post to the other is just the amount desired (Fig. 15). If it should not be sufficient, the one-eighth of an inch that extends beyond the tubes can be utilized by unsoldering the post and resoldering as far distally as necessary to give the desired length of arch (Fig. 16). If for any reason this is not sufficient, or in case of a broken or lost arch, take an impression in modeling compound, which will show the tubes, and a new arch can be made very quickly, and by slight adjustments in the mouth can be fitted nicely.

Retention.

My conception of orthodontia is that we are not only trying to restore teeth to what we have termed normal occlusion, but to restore the tissues and organs which constitute the oral cavity to normal function. From the time you start to treat a case of malocclusion with the lingual arch, until it is finished, it might be considered a continuous retainer, as it interferes so little with normal functions, and is constantly assisting in the development of these oral tissues in the direction of normal growth where Nature has failed.

This paper is by no means a complete analysis of the removable lingual arch, and is only intended to show that tooth movement can be produced.

I have not touched on its use in connection with the labial arch, or by the use of the wire-stretching pliers, as this has been so ably presented by Dr. Lourie.

1520 Spruce Street, Philadelphia.

Discussion on the Papers of Drs. Alfred P. Rogers, A. Leroy Johnson, and John V. Mershon.

Dr. Hugh H. Hatfield, Boston, Mass.

One of the most striking things about these three papers, it seems to me, is their completenes in sequence. Dr. Johnson emphasizes the fact that there is a normal for each individual, and that this may vary widely from the average or normal for the species or race, and that the ideal of a perfect arrangement of teeth to give absolute occlusal contact may or may not exist in this present day.

He makes it clear that the individual normal must be determined by a consideration of factors other than tooth form. He shows the importance of studying, not so much the models, as the case history of each individual by every aid science possesses, realizing that in the complex interrelations which the body presents, we are dealing with a set of processes entirely without parallel in the inorganic world. To still hold that a shoulder to shoulder arrangement of contact points and a more or less perfect interchange of stimulating force through the occlusal planes, is the sole maintaining force, is folly. He urges a greater study of quantitative measures and a more comprehensive, intelligent and exact use of statistics, that more light may be thrown on our subject. Some one has said that, "nothing is fully known until it can be expressed mathematically." To mention one unknown quantity, do any of us know yet the relative frequency of this condition of malocclusion?

Dr. Rogers and Dr. Mershon have both presented extremely interesting forms of treatment. Dr. Rogers has demonstrated the manner in which a physiological effort is made to bring out the development possible in each individual child, a better muscular tone, a very potent factor in maintaining built-up bony structures. This is the functional factor, the constructive agency in form development, but the inherited element in the organism must determine the possibilities of development.

Dr. Mershon has shown the simplest possible artificial means of stimulating and changing the alveolar structure in our effort to aid nature in development, interfering least with physiological activity of the parts.

Too much unpractical and unscientific theorizing in the clinical field has made our specialty top heavy, and to keep our foundations solid and commensurate with the superstructure, is one of our problems today.

Dr. Alfred P. Rogers, Boston.

My paper might be accepted as a discussion of Dr. Johnson's paper. However, I wish to make a few remarks.

Dr. Johnson's treatment of the subject is philosophical. He goes into it in a most unusual and thorough manner. I want to say, that I do not believe any one can comprehend this afternoon the absolute reasoning or meaning contained in the present symposium. I had the privilege of reading this paper on the train, and I was obliged to read it and reread it before I could grasp the deeper meaning which the author tries to convey. But I can recognize that one of the fundamental elements of our progress is that we should follow up the study that Dr. Johnson has so ably presented to us. I congratulate the society on having had Dr. Johnson's paper.

Dr. M. N. Federspiel, Milwaukee, Wis.

In regard to Dr. Roger's splendid paper on muscle training, I must say it is an inspiration to all of us to go home and try to do better work. Muscle training has been practiced in medicine for some time in curing kyphosis, stooped shoulders, and pigeon breasts, and the results obtained from so-called gymnastics, particularly the end results, have been wonderful.

The science of orthodontia is an organic part of medicine. It cannot be separated, and we will be obliged to understand the various sciences that enter into the treatment of applied biology.

I cannot add anything to what Dr. Rogers has said except to compliment him.

Dr. C. A. Hawley, Washington, D. C.

It seems to me that we have had three of the best presentations I have ever listened to before this society, and they have been in natural sequence. I will say in regard to all of the papers that they have been by gentlemen in whom, from long association, we have the greatest confidence; men who are conservative and essentially students of science, and to whom we can listen with the greatest interest.

Dr. Rogers's paper opened a field that we may have conceived existed, but we have not had the genius to develop it, as he has. We have talked for a long time about the primary causes of malocclusion, lack of function, and so on, and yet we have not really conceived the method of correction as Dr. Rogers has done. Of course, in regard to just how far patients will go, and how much they can do, we who have not tried it are ignorant, but it offers the most hopeful prospect of anything to which I have listened. I heard a similar paper by Dr. Rogers, some time in April, and talked over the matter with him personally, and I can relate to you what little experience I have had.

I went home and took up two cases, which probably are typical of those we often meet with in practice; cases in which I had succeeded in obtaining practically normal alignment and arch form, but in which the mesio-distal relation was not normal. I had used intermaxillary ligatures again and again but was unable permanently to restore the position of the jaws. I sat down and talked to these patients and explained to them that I had done everything that I knew how to do, and told them that now the question was for them and I tried to give them as nearly as I could, these exercises. One boy I had worked on for a long time, and I had established normal occlusion again and again, and yet while the position of the teeth would allow his biting forward in the proper position, in a short time the muscles would relax, and he would come in with the lower jaw retruding just as badly as ever. He was a boy of intelligence and understood the problem and went to work at it, and in two months' time he himself made more improvement than I had ever been able to do before. I am greatly encouraged, and I believe from this experience that I can thoroughly indorse Dr. Rogers's treatment.

Here is a phase of the subject that strikes me as very important: Patients are apt to come to us with the attitude, "I have malocclusion, and you are to correct it." Dr. Rogers places a different aspect on the question. He says: "I can do so much, but you have your part to do; it is a co-operative procedure." I think that is very important, and I never realized until I heard Dr. Rogers's paper, the importance of it. It seems to me, that the extension of this work will do more to put orthodontia on the proper basis than any aspect of the work that has ever been presented.

The Lingual Arch.

In regard to Dr. Mershon's paper, the author devotes the introduction of his paper to a discussion of the functional activities of teeth and associated organs during the progress of othodontic operations. I heartily agree with his statements. In a broad way, it is generally agreed that malocclusion of the teeth is the result of lack of their use in childhood, especially during the period from the completion of the deciduous denture to the time when the first permanent molar is erupted and the deciduous teeth begin to be lost. The habits of mastication and the development of the muscles concerned with it are mainly formed during this period. How important then it becomes that these habits be not obstructed nor lost by the interference of othodontic appliances, and that the health of the surrounding tissues be maintained as well as the natural movement of the lips, tongue and cheeks. In this connection, contrast the simple appliance which the author describes, with the old sixteen gauge labial arch having the usual number of bands and wire ligatures, or the later pin and tube appliance, or even the ribbon arch with its necessary bands and brackets. The one leaves practically free the function of the individual teeth as well as the cheeks and lips; and others practically destroy them all. In the hygiene of the mouth the contrast is equally marked. As efficiency is the first requirement of an appliance it will naturally first be asked, "Can the work be done with so simple an appliance?" The paper of the essayist is a competent answer.

As to the technical part of the paper, there are a few points that I might discuss. While in the majority of cases straightening the bends and kinks of the wire will produce sufficient length, if needed, a small amount can be gained by making each bend at the compound bend in front of the molar pin, a right angle bend, then later making them obtuse. A small loop can also be made at a favorable place and later straightened, if thought necessary, or the wire may be cut and a piece taken out or put in. In any such manipulations, however, the greatest care must be taken not to disturb the relations of the pins to the tubes on the molars.

My own favorite size of wire is 0.35 or 19 ga. However, some of my best results have been obtained with 0.30 and I have used some 0.28 with advantage. Greater changes can be made at one time with the smaller wire, but at the same time, the stability of the arch form is not so great, and it is more likely to be bent by the force of mastication. It is also not so favorable for the attachment of auxiliary springs.

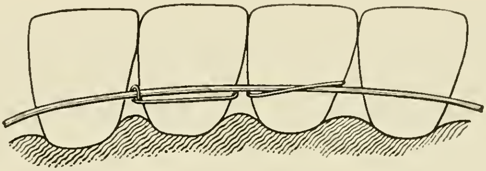

Fig. 1.

I find heat treatment valuable in restoring the temper of the arch, especially after attaching auxiliary springs. The arch is heated to redness, preferably in an enclosed receptacle, and then cooled slowly in the air.

The essayist has wisely cautioned against too much change at one sitting. As I look back at my first experiences I am satisfied that this was one of my prominent faults. A beginner will naturally ask, "How much change can be made in one sitting?" While this is very hard to answer, yet of one thing we can be sure, an arch should never be changed so much that it will not snap back to place and retain its position. It must be remembered that we are depending in the use of this appliance considerably on the force also exerted by the natural function of the teeth.

There should be great caution concerning the changes made in the pins attached to the molar teeth, especially when using the heavier arch. If care is taken in the impression and model, there should be no soreness after the first adjustment, but any subsequent adjustment that disturbs the relation of the pins with the tube, places strain on the molars.

In my experience it is not desirable to leave the arches without some fastening to other teeth than the molars. They may go along for months without accident; then by the use of sticky candy or lifting with the fingers to relieve some slight irritation, the arch may be bent and lifted from place. I first banded some convenient tooth and placed a short lug for the arch to rest under to avoid this accident, but later have made use of what I call a loop ligature. (Fig. 1.)

The ligature may be of gold or the usual composition wire and unless rotation is necessary, answers every purpose in securing stability of the arch.

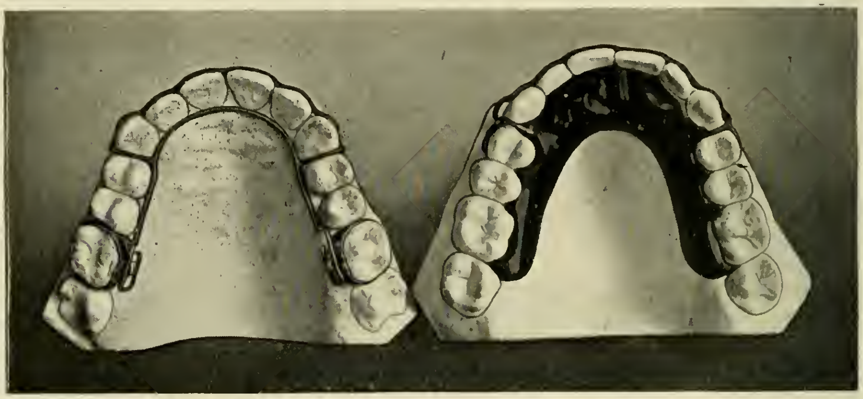

Fig. 2.

In some cases additional root movement may be desired in the incisor region. While this movement is not necessary so often, as in the use of labial appliances, owing to the free action of the lips, yet in many cases I have preferred to make this movement definitely in as short a time as possible. For this purpose I have used the old labial loop of light spring wire, .022 attached to the lingual wire just distal to the cuspids and coming through this opening which is present even in the most perfectly occluded denture. With the lingual arch resting closely against the teeth at the gingival border and the labial loop wire passing close to the incisal edge, root movement can be easily and quickly obtained. Considerable rotation can also be obtained with this wire. (Fig. 2.)

I also use the Lourie arch. The essayist mentioned the fact that the lingual arch may be continued as a retainer and rightly considers it valuable for this purpose. It still, however. has the objectionable feature of the molar bands.

To obviate this danger I have been using for the past year a form of retention developed from the McBride retainer. which I showed before the society about ten years ago at the Detroit meeting. This retainer consists of a skeleton plate of gold or vulcanite with wire anchored in the plate and passing to the labial side at the distal surface of the cuspids with clasps over the bicuspids. The wire as far as the forward portion of the loop, is made of 19 ga. clasp gold and the labial portion of ribbon arch wire. (Fig. 3.) If the plate portion is made of gold, it should be cast, as it must absolutely fit the lingual surface of the teeth. The principle is that a tooth to rotate must rise away from the plate and the close fitting labial wire prevents this movement. If such a movement does start, slightly tighten the labial wire so that it will press harder on this tooth on the corner that is moving and it will quickly bring it back to place. After wearing the retaining plate continually for three or four months, I have found it sufficient if it be worn only at night. It will not, however, retain the rotation of small round shaped lateral incisors nor lower bicuspids.

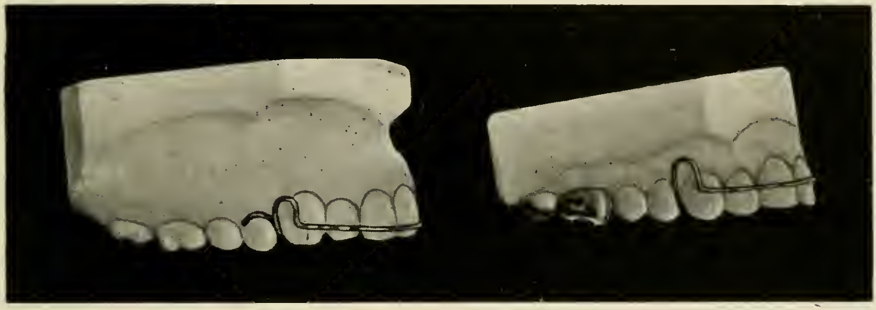

Fig. 3.

I have been working on this appliance for the last ten years but have at last reached this form and I hope it will be successful. I am speaking of it at this time in view of its value in connection with these three papers. In the first place, there are no bands upon the teeth. In the second place, after being worn a short time it can be removed during the daytime and only worn at night. That makes cleansing of the teeth perfect and makes the use of muscle exercises much easier.

During the last six months I have placed over sixty of them in the mouth, and I have not yet had a serious failure, but I may have a big lot of trouble next year. I do not know.

Considering the whole scheme of treatment, as outlined by the essayist, and which no doubt is susceptible of still greater development, it offers for our study and effort a treatment with which reasonable prophylaxis is possible and easy, a method in which the teeth are reasonably free from the use of disfiguring and irritating bands and where the tooth-brush and floss silk can be freely used and, most important perhaps of all, where the function of the lips and teeth are very little interfered with.

There was one point more I would like to touch on. Dr. Mershon spoke of the time that elapses between sittings for treatment. That becomes reasonable and easy because it is unnecessary to hurry treatment with this simple appliance. Many of these cases are treated without a single band on the anterior part of the mouth. Where the teeth are all tied up with bands and brackets, you are tempted to hurry and get these things off as quickly as you can.

Dr. J. A. Burrill, Chicago

I have not had the opportunity to read any of these papers before they were presented, so I am not in a position to discuss them carefully and intelligently. I am down to discuss the lingual arch, however, and I have this to say: Dr. Mershon's treatment is so much like some of my own, judging from his description, that it is hard to add anything to it. If there is any place in which I can criticize his removable lingual arch, it is in the number of the springs. In my experience I have found that with a removable lingual arch with two or three auxiliary finger springs, as he calls them, there is too great lack of stability and consequent irritation of the gum. It had been my observation that I can get along with less irritation of the gum by using bands instead of so many finger springs. However, I have had a good deal of success with the removable lingual arch in the way of general expansion, and after obtaining the general expansion to stabilize my lingual arch, I have added a labial bar which is parallel to the lingual arch, and which lies in contact with the labial surfaces of incisors or incisors and cuspids as the case may require. (Fig. 1.) This labial bar is attached to the lingual arch by means of two short loops which lie in the incisal notch between the laterals and cuspids. These parallel bars are sufficient in some cases to rotate and retain incisors in torsal occlusion.

This appliance is also useful in depressing the incisors and lifting the anchor teeth in opening a long overbite. It is much more applicable, however, to the lower dental arch than to the upper. The drawing shows the manner of attachment of this labial bar as well as the style of clasp which I have used a great deal for attachment to the anchor bands. I have this to say, however, that I am gradually giving way to the soldered lingual arch and wire stretchers for such cases of expansion, and I think I am getting better results.

Judging from the questions that were asked Dr. Mershon, I was led to feel that some of you were criticizing him for the length of time he took in accomplishing what he did in the particular case where it required one year. I feel that the extra time spent in carefully and

to the soldered lingual arch and wire stretchers for such cases of expansion, and I think I am getting better results.

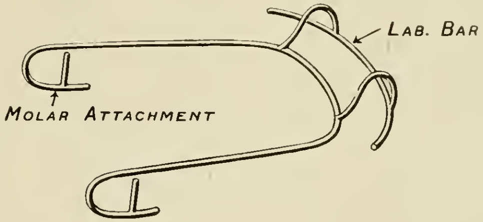

FIG. 1.

slowly working these teeth into position shortens the necessary time for retention when that period comes, and as he said to us, the lingual arch is often all the retention that is necessary.

I feel that I cannot help but refer in the matter of retention to the papers of Drs. Johnson and Rogers, and emphasize how necessary, along with the active forces of occlusion, are the normal muscular forces that have so much to do with the permanency of our results.

Dr. Milton Watson. I have been much interested in all of these papers, and delighted to see that our problems are being approached from so many different angles. It is a hopeful sign.

I have a suggestion to offer in regards to the auxiliary springs Dr. Mershon spoke of. By using a wire drawn to two different gauges it is possible to solder the heavier, or base end, without injuring the temper in the thinner portion; the result being a very delicate, but extremely active spring. These springs are made by taking a short piece of wire, which has already been drawn to the proper gauge for the base, or heavier, end of the spring, and putting it through the next smaller hole in the draw plate, but stopping while there is still approximately a quarter of an inch of wire to the heavier gauge. The wire, of course, has to be withdrawn from the plate backwards. Springs made in this way have proved much more satisfactory in my hands than where wire of the same gauge is used throughout the entire length of the spring. Retempering is, of course, unnecessary.

Dr. Ralph Waldron, Newark, N. J. It has been my pleasure at the invitation of Dr. Mershon to go to Philadelphia and see him work, and the only comment I have to make upon Dr. Mershon's paper is to say that he has been too modest in his claims for this appliance.

I have experimented a great deal with the material used by Dr. Mershon, namely, platinum-gold alloy, and find it to be a most admirable material to work with for it can be annealed and tempered as often as required without the loss of any of these properties.

If you will take a piece of No. 4 wire (Aderer) or E wire (Ney & Co.), and place it on a copper pan which is about 14 gauge (B. & S.) and heat the copper pan to a bright red heat, and then plunge the wire into cold water, this will anneal the wire so it will become soft enough to tie in a knot without breaking. Now if you will put this wire on the copper pan again and heat it as before, until it becomes a bright red color, and then allow the pan and its contents to cool in the air, all the original spring temper this wire possessed will be restored.

Some member has asked how is it possible to get the spring effect in the finger which has been soldered to the base wire.

The base wire is 19 gauge or about .037 of an inch in thickness. The finger spring is only .022 of an inch in thickness and after soldering with 18 or 20 karat solder, upon cooling in the air it becomes springy again. Bending the finger spring to the desired shape adds a little more spring quality to the finger; this is sufficient for all the force needed to move individual teeth.

Dr. Robinson. Does this restore the temper given to it by the draw plate after it has been heated?

Dr. Waldron. You can restore the original temper exactly as it was when it left the manufacturer, because the manufacturer anneals and tempers this wire after it leaves the draw plate, and before it is sold to us for our use.

Dr. Robinson. I would like to get the formula of the wire.

Dr. Waldron. I do not know the exact formula, but the No. 4 wire is far superior to the other wire manufactured by Mr. Aderer, and he informed me that the No. 4 contains: Au., 84 parts, Pt., 23 and 8/10 parts, and Cu. and Ag., 35 parts.

Dr. Robinson. I have never seen a wire that could be heated in any way to give any such temper as it has when it comes from the draw plate.

Dr. Waldron. I would like to ask Dr. Mershon if he has not found that he can get all the spring he wants in the finger wires by allowing the appliance to cool down in the air after soldering.

Dr. Mershon. By allowing it to cool down and bending the wire you may not get the same temper you had in it originally, but I can say that in all cases the spring is sufficient.

Dr. R. Ottolengui, New York City. I did not really intend to contribute to this discussion, but I am tempted to say something in reply to Dr. Hawley. Dr. Hawley in speaking of his retaining plates, said that they must be cast, because they must fit accurately to the lingual surfaces of the teeth.

I have had a very considerable and very unpleasant experience with cast gold plates. Plates that are cast are necessarily heavily alloyed with low grade metal. That may be one of the reasons for the trouble that I have observed. Another possible reason is that in casting these plates the surface comes out granular, and in our desire to get an actual fit to the surface which comes in contact with the gum, the plate is not really polished. The granules are not removed. Whether it is a chemical disturbance or a traumatic disturbance due to the granular surface I do not know; one of these plates worn in a mouth for a year seems to cause a chronic inflammation of the mucous membrane. That can all be avoided, and Dr. Hawley's wishes can be fully met, so far as perfection of fit is concerned, by making accurate models, and accurate dies. Then swage a plate of 36 gauge pure gold; then with another set of dies swage another plate of 20 carat gold; then sweat two pieces together. You have a smooth, polished pure gold surface against the gum; you have a fit; you do not have the inflammation you get from the other styles of plate, and the plate is just as rigid as if made by the casting process.

Dr. Frederick C. Kemple, New York City. The presentation of these three papers this afternoon by these gentlemen has been most gratifying to me. I think it offers a very interesting study in the evolution of the practice of orthodontia because, it seems to me, that we are getting back to certain fundamental principles; we are getting away from complicated methods and compulsory change by mechanical forces. We are getting away from the idea that we can take the mouth of a patient and mould it into any form that we choose in spite of Nature's dictates, or in spite of physiology or function.

I think that the paper presented by Dr. Johnson is one that ought to be read and reread and studied, before it can be fully understood and appreciated; and particularly by men who are interested in orthodontia, because it gives an exceedingly broad view of the fundamentals of orthodontia.

I must say, I agree with Dr. Rogers in regard to the efficacy of muscular development. There is no doubt but that if these muscles are toned up they will aid materially in restoring natural function, and with the presentation of the lingual arch and the little finger springs allowing individual tooth movement, I think we have a most hopeful sign, because despite the very extreme enthusiasm that greeted the introduction of the pin and tube appliance, such complicated apparatus seemed to me a backward step in orthodontia. It seemed to me to be getting away from natural function.

I believe the presentation of these papers this afternoon, in a general way marks another era in orthodontia. I know that several of these men were once very enthusiastic about the use of the pin and tube appliance, yet now we are getting back to the point of preaching and teaching freedom of individual tooth movement in all of this work. This is very gratifying, indeed.

Dr. V. H. Jackson,
New York City.

I am interested in seeing how we are working towards the more general use of wire springs for moving the teeth. I am glad operators are getting thorough experience with different forms of springs. It is pleasing for persons who have made and used them to know what results others get with them. I hope we will keep up their use. There is no doubt about the advantage of these forms of lingual springs. I am very enthusiastic over the value of the spring for causing tooth movement, having had long experience with the use of both lingual and labial springs. I prefer the lingual spring for the general expansion of the arch when it is shaped to use to advantage.

I am very much pleased at the exposition we have had here to-day and I shall be interested still more in seeing how we continue to work in the future. I am gratified and would do anything to help in shaping the spring to make it still more effective.

Dr. A. Leroy Johnson, Springfield, Mass. (closing). I have nothing to add to the discussion, but I would like to take this opportunity to thank you for the privilege of attending this meeting of the American Society of Orthodontists. I am enjoying it immensely.

Dr. Alfred P. Rogers, (closing). I wish to give credit for the arrangement of these papers where it belongs. In Boston we had the pleasure of a visit from Dr. Mershon, and I had the pleasure of a visit from Dr. Johnson, and naturally both of them tabooed professional talk. However, we got into various sorts of arguments and discussions, and Dr. Johnson, who saw the wisdom of combining the three papers in sequence suggested it to me and we suggested it to the Board of Censors. It was the plan of a philosophic mind to arrange these papers as they have been arranged in our program.

Dr. John V. Mershon, Philadelphia, (closing). I have nothing to say in closing the discussion on my paper, except that I regret that Dr. Burrill did not have a copy of it to read before he began his discussion. Dr. Burrill spoke of the great number of springs I am using. It would appear that I use auxiliary springs almost exclusively, but the fact is I do not suppose I use an auxiliary spring in one case out of twenty, thirty, or forty. I showed a great number to-day merely to demonstrate the various movements which can be produced by their use.

What Orthodontia and Orthodontists Have to Offer to Our Own, As Well as to Allied Sciences.

By Bernhard Wolf Weinberger, D.D.S., New York City.

What I have to offer to the American Society of Orthodontists today I know is different in character from my two preceding papers; nevertheless, there are many factors previously described that again make their appearance, but this time in an entirely different form. In describing cases I have selected those found in one orthodontic practice which have not only proved instructive in orthodontia, but have become valuable material for allied sciences. At the same time this paper will introduce a new procedure, heretofore for some unknown reason overlooked in this association; nevertheless the like is conducted as a yearly contribution and a practice in many scientific societies, and I trust in the future will be the regular procedure at our sessions.

Orthodontia became a recognized science only after it outgrew the care and strength of the parent "Dentistry." Since leaving what was the adopted home, the child has developed in stature beyond that of its ancestors and seeks support, nourishment, and vitality in those branches of science that permit further growth and life. Orthodontia wants and will take all that such sciences as anthropology, biology, embryology, comparative anatomy, psychology, etc., can give. Orthodontia today is a study of many and varied scientific subjects, and in order to accomplish our mission and purpose we have asked men in the above sciences to cooperate with us; we have brought their students to our meetings to give their knowledge in papers on any number of subjects and they in turn have asked for like assistance and cooperation from us; but so far, that which we have pledged ourselves many times to do, remains undone.

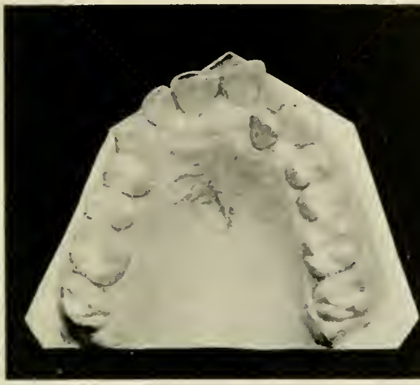

Fig. 1.

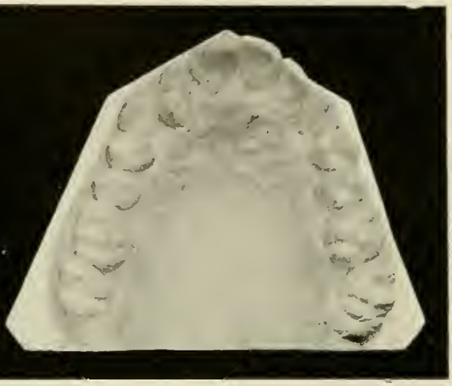

Fig. 2.

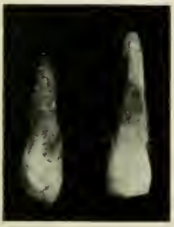

Fig. 3.

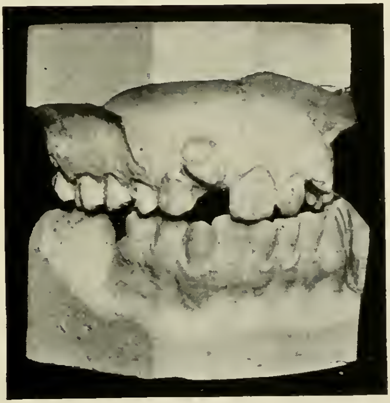

Fig. 4.

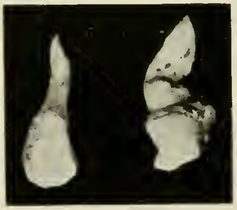

Fig. 6.

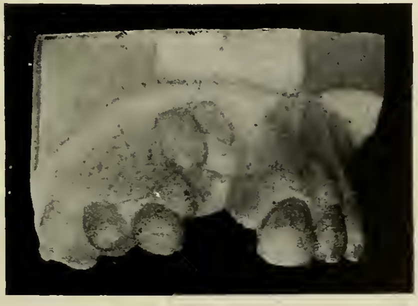

Fig. 5.

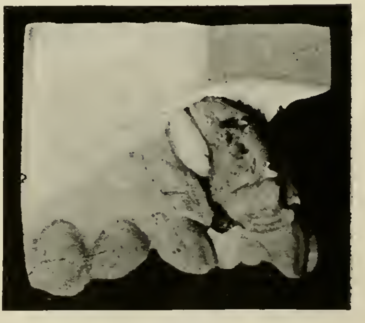

Fig. 7.

My purpose, therefore, is to present a few cases that I find have interested associate co-workers, and which at the same time will, I trust, add additional knowledge to orthodontia. All of you have undoubtedly similar, in fact perhaps more interesting cases in your respective practices; I trust for the sake of some men who desire this information that you will in the future record them.

To the anthropologist, biologist, as well as comparative anatomist, supernumerary teeth as found in our orthodontic collections seem to concern them the most. Although I find that each branch of science looks upon this phenomenon from an entirely different viewpoint, they still all come to the same conclusion. Therefore let me at the outset consider a few of these cases. The biologist considers this deviation a question or a problem in heredity or non-heredity, while the anthropologist and comparative anatomist not only of heredity but one of reversion or atavism.

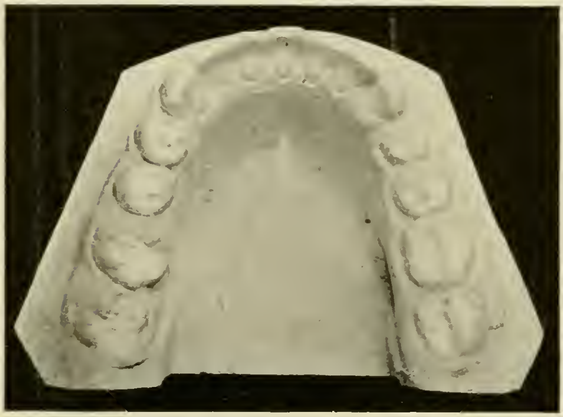

Fig. 8.

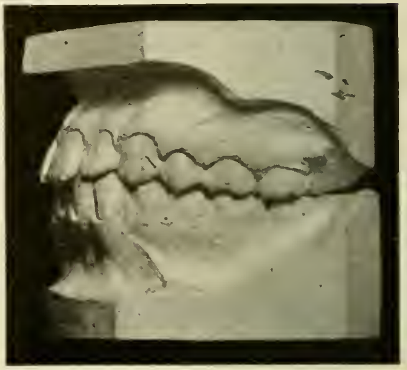

Fig. 9.

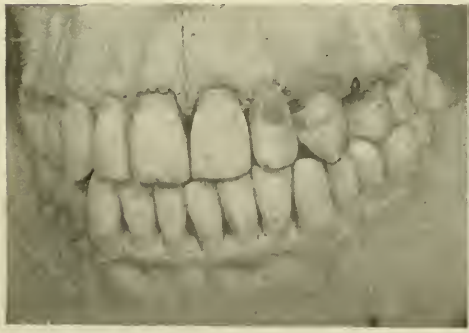

Fig. 10.

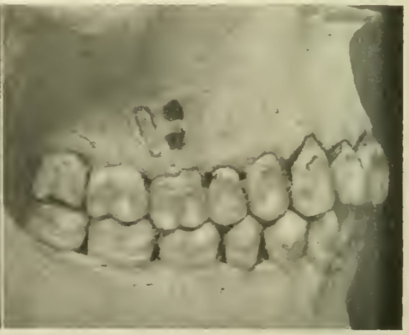

Fig. 11.

The first case that will be reported is a type I know from experience interests all of our scientific brethren. Figs. 1 and 2 are from brother and sister, aged thirteen and fifteen respectively, each having a supernumerary lateral situated almost identically within the dental arch, although on opposite sides, causing the permanent laterals to erupt on the palatal surface. The fact immediately enters our mind that here is a condition that is analogous in two members of one family; but of greater importance to us as orthodontists is a question that I do not believe has been previously considered.

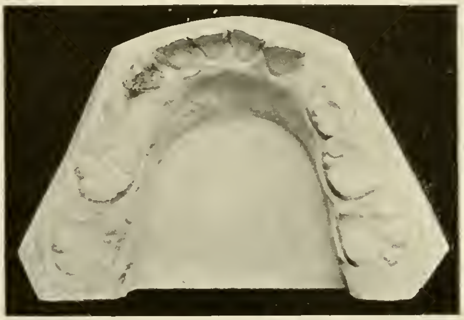
Fig. 12.

Why do supernumeraries erupt first? That they do this in nearly all cases (examine models) is certain, otherwise the permanent teeth would be found in their regular and not in some abnormal position. Finding, as we do in these two particular cases, conditions that are so similar, the question of heredity enters into immediate consideration. This is a problem we as orthodontists can not solve, but we all know how often parents constantly inquire and desire an answer.

Supernumeraries that are similar to these are numerous, but not all are as easy to be differentiated from the permanent tooth as in this case. Here radiographs showed that the tooth within the dental arch had the shorter root, while the crowns proved to be smaller in diameter as well as being more irregular in shape. This can be seen in Fig. 3, a photograph of the two extracted supernumerary teeth.

Case II. The next case, another containing a supernumerary tooth, might merely represent an addition in number to our friends; to us it presents a more complex problem. (Fig. 4.) Here again we find that the abnormal tooth has erupted first, causing the peculiar impaction of the upper right central incisors and cuspid as seen in Fig. 5. Here again we are forced to ask the question: "Why has this tooth assumed its peculiar twist and shape, as well as preventing the above described teeth from erupting?" (Fig. 6.)

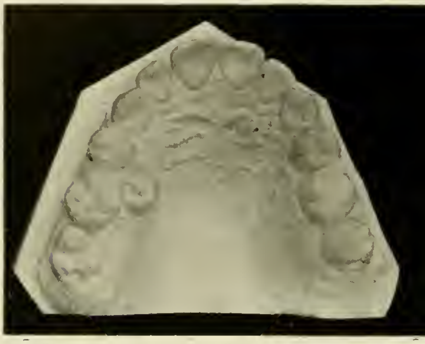

Fig. 13.

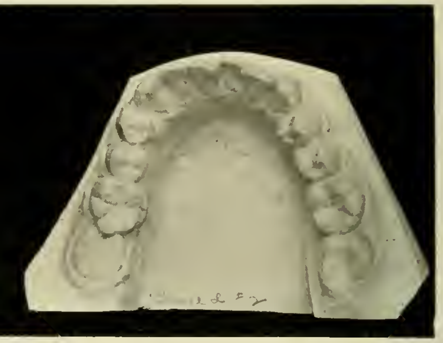

Fig. 14.

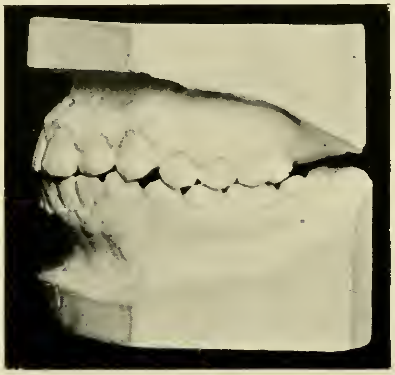

Fig. 15.

The answer to this is more easily seen by referring to Fig. 7 which shows the impacted tooth, as nearly as possible, restored to its former position. All can readily see where the pressure has been applied as well as the effect it has had on the formation of the root of the supernumerary tooth. The deciduous tooth being in its normal position while the crown of this tooth was forming has undoubtedly caused it to assume this shape. Has the position of the supernumerary between the deciduous and the germs, later the crowns, of the permanent teeth any particular bearing upon the peculiar formations of these teeth, and to what extent do they cause impactions? The example, I believe, is ample evidence that we must pay closer attention in orthodontic cases to supernumerary teeth, as to what results they have on dentition, on the formation of crowns and roots as well as on impacted or missing teeth: a further study will prove beneficial.

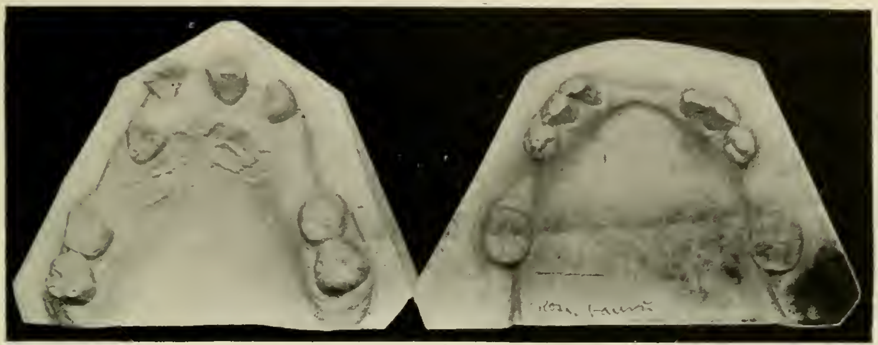

Fig. 16.

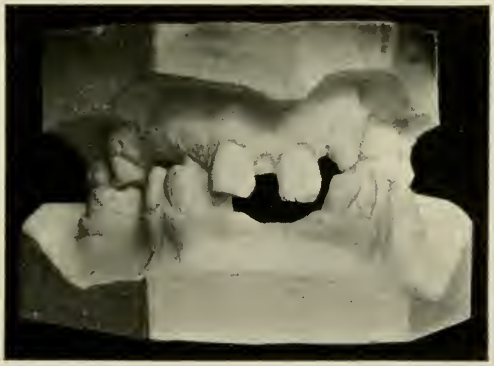

Fig. 17.

Case III. Supernumeraries upon erupting do sometimes fall within the dental arch line without causing a disturbance or irregularity of the teeth. Nature, broadly speaking, in her wisdom undoubtedly has provided for such contingencies, as shown in Fig. 8. We here find lower incisors, all of the same shape, size, and regularity of form, while the radiograph shows the roots of each to be of equal length. Seldom have I seen as perfect an alignment even when the normal number are present. Fig. 9 illustrates the upper and lower dental arches in occlusion, (the right side is almost identical) and except for a slight overbite the occlusion is perfect. I doubt if any of you would care to extract a tooth to reduce the size of the lower arch. Has the arch been compensated by increasing the tooth substance in the upper to take care of the increase of the extra tooth in the lower, or has the amount of tooth substance in the other lower teeth been reduced to bring about occlusion? In this case it looks very much as though it did undoubtedly follow one or the other of these procedures. This is a question that has often been raised at these meetings, but so far remains unanswered.

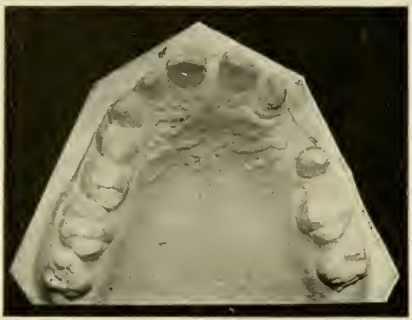

Fig. 18.

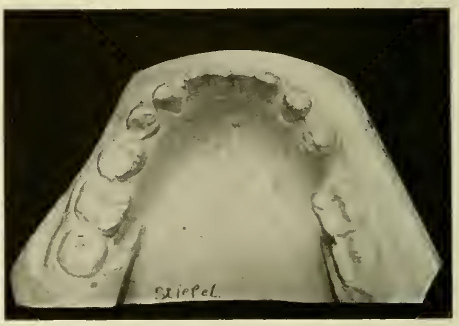

Fig. 19.

Case IV. A similar condition is shown in Fig. 10. Here again we find a short overbite, but this time there is slight overlapping of the lower anterior teeth. Observe the extreme width of the incisors. Again we are forced to ask a similar question as in the preceding. Fig. 11, the side view, illustrates that here again is to be found an occlusion that is even more normal than in Fig. 9.

Case V. Fig. 12 represents a similar case of five lower incisors, but conditions here were quite different and forced us to extract the tooth on the extreme left to make room for the cuspid. This illustrates that nature does not always follow definite or set rules.

Case VI. Fig. 13 represents the upper arch of the brother and here again an interesting problem presents for our consideration as well as that of the biologist. The upper left second premolar is missing, the molars have erupted just back of the first premolars; I say erupted and not drifted because otherwise there would have been a tipping of these teeth. Fig. 14 is that of the lower, and we find the articulation, as shown in Fig. 15 nearly perfect. Here is a case in which the question involves whether we are justified in opening the spaces between the premolars and molars on the left side and inserting a tooth, while on the right side bringing the premolar into its normal position, or whether we would be excusable to extract this tooth. The brother, being the older and lacking a tooth, I have wondered whether nature tried to compensate in the sister that which she neglected in the brother by the addition of the tooth.

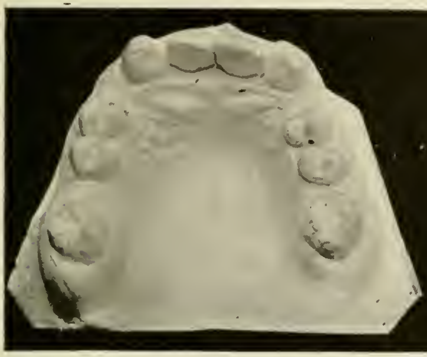

Fig. 20.

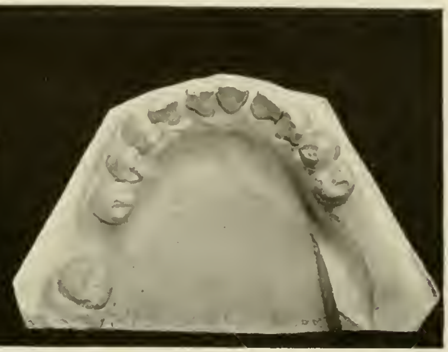

Fig. 21.

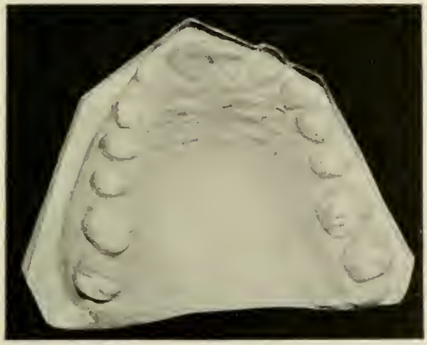

Fig. 22.

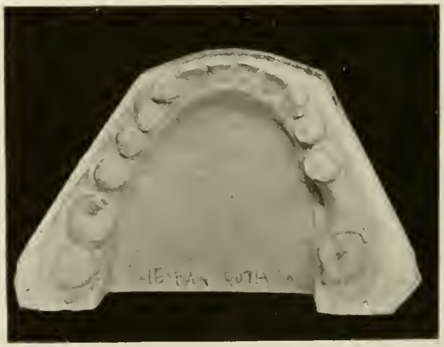

Fig. 23.

Missing Teeth.

Missing teeth is another problem that is of great interest to our friends. I need not tell this assembly the problems and tribulations that they bring to us. Fig. 16 represents an extreme case of this type of missing maxillary lateral, premolars and all molars with the exception of the first permanent ones. In the mandible, centrals, premolars and second and third molars are missing. The radiographs fail to locate germs or teeth. The dental arches are shortened, with the lack of alveolar process, due to non-eruption of teeth. No negative ancestral history in the family has been found as far as can be determined. Fig 17 shows the articulation.

Case II.

Another case, not as extreme, is shown in Fig. 18. Here the maxillary premolar and the mandibular second premolars are missing. (Fig. 19.) We note peg laterals above and diminutive ones below. Another sister in the family presents a similar condition, yet both parents have the normal number of teeth. The third generation, the ones that would prove the most interesting in the history of this case, I can find out very little about.

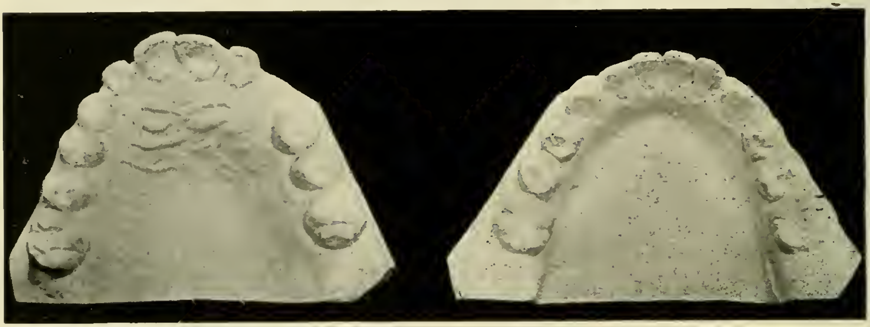

Fig. 24.

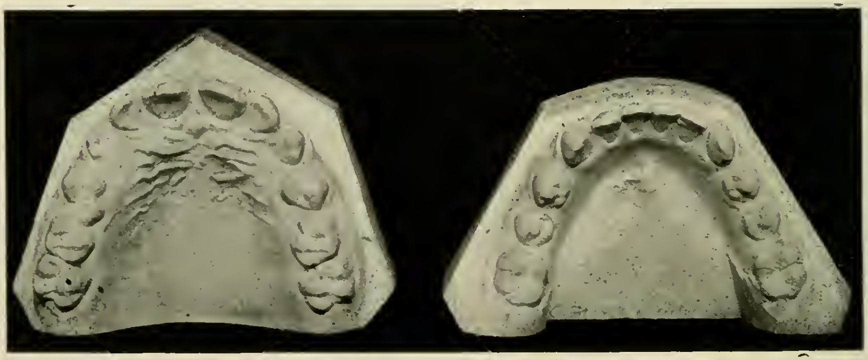

Fig. 25.

Cases III and IV.

In connection with missing teeth, there are two more cases I desire to record, not so much as to the non-presence of teeth but on account of the peculiar condition often associated with them, and also as in this case the similarity of conditions in various members of the family. Figs. 20, 21 and 22 are of two sisters with upper laterals missing; a third sister also lacks these teeth. No third molars have erupted or are to be found. In Fig. 23 we find not only the presence of the lower left deciduous cuspid, but the permanent one as well. This is a condition we are apt to find in this type of case as well as sometimes the entire absence of the permanent cuspid.

Internal Secretions.

Wherever we have the presence of both the deciduous and permanent teeth, or the non-presence of a tooth, we have without doubt the problem of internal secretion to contend with. This leads us to one of the most complicated factors in orthodontia, the one we know so little about and are beginning to meet so often in our practices. It is a problem we must leave to our medical co-workers to solve, and until we ask them to aid us in this work, the etiology of our cases will remain obscure. We as orthodontists can and must call their attention to this type of case and seek their cooperation early enough to prevent in the patient the more complicated conditions such as goiters, etc., from arising.

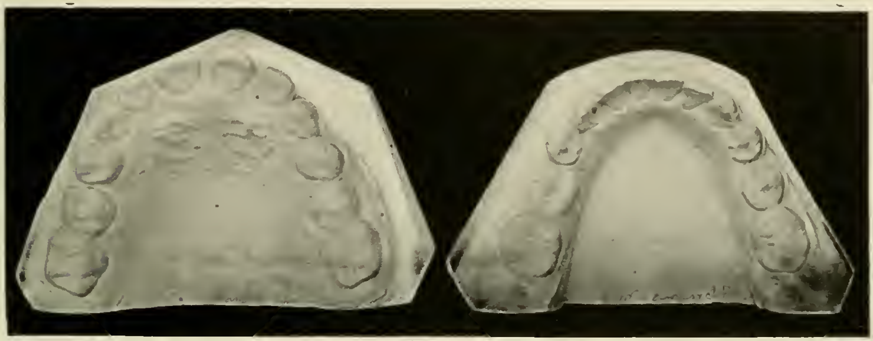

Fig. 26.

The next figures are two of six I showed last year, calling your attention to the importance of observing spacings between the posterior teeth. (Figs. 24 and 25.) Fig 26, a case I recently had in my office, is probably the most interesting of them all, as it shows the overgrowth of both the maxilla and mandible better than any of the others that I have so far reported. Strange to relate here is a coincidence as in the other cases, namely that we find the mother suffering from and being treated for thyrodism, either hyper- or hypo-. As much as some orthodontists desire to overlook this state of affairs, they cannot avoid this phase of the subject, and therefore all of us must go deeper into our investigations along this line. In the above mentioned two cases, Figs. 24 and 25, I desire to report here, that both have been under medical supervision for a year, and I am glad to state there has been no increase in bone growth, although at the age of thirteen one would expect some further normal

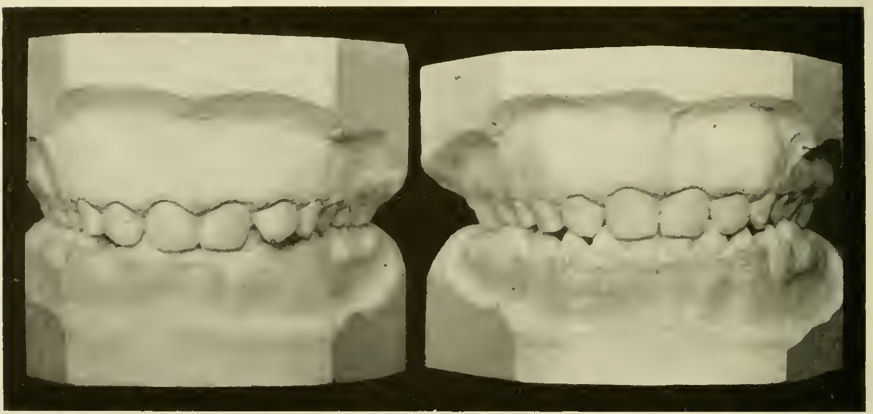

Fig. 27.

Fig. 29.

development, thus showing that the increase previously reported has been arrested, and now orthodontic treatment might be of some assistance. How strange it is that only recently we began to realize that this growth must first be checked physiologically before beginning treatment of these cases.

Another phase of internal secretion, one that the orthodontist meets often but has not as yet realized the vast importance of, is shown in

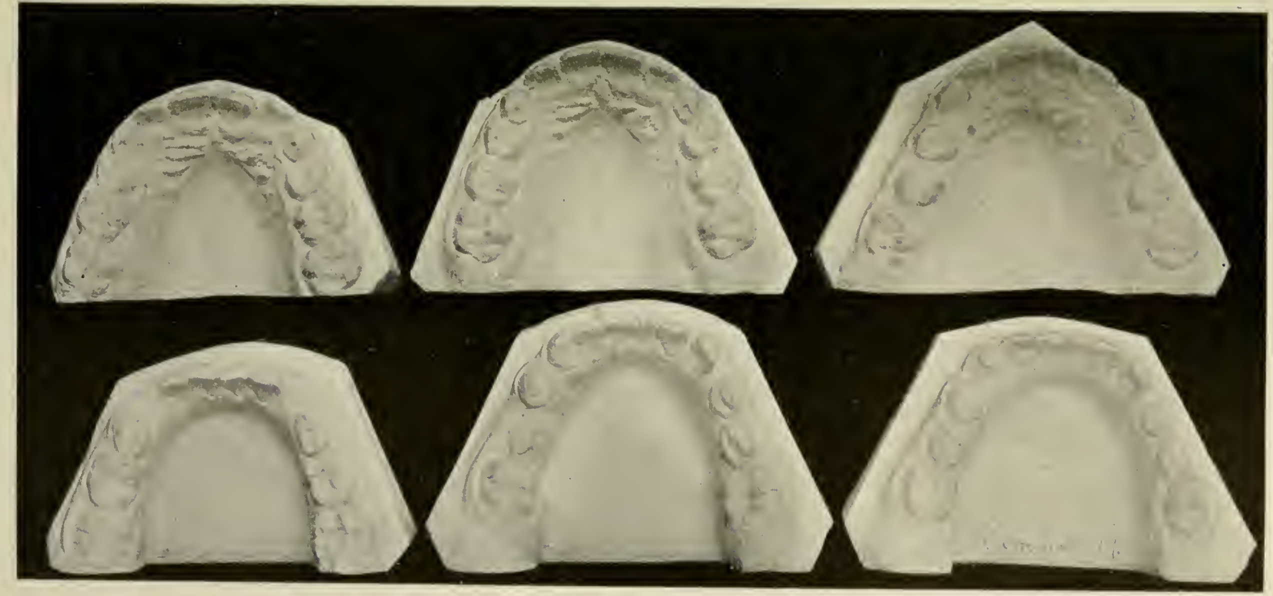

Fig. 28.

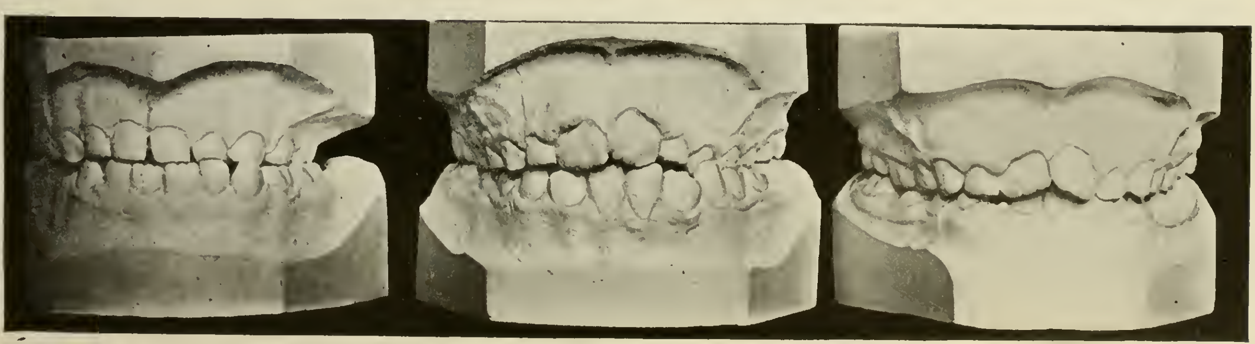

Fig. 30.

Fig. 27, a case which has proved of interest to various men. I did not take into consideration, until I was led astray, certain important fundamentals at the beginning of treatment. Therefore I will give a brief history of this case, knowing it will bring to your mind similar conditions which some of you undoubtedly have met. Fig. 27 shows the front views at the beginning and half way through treatment, after I thought that occlusion was established and the bite had been opened. Had the teeth been normal in shape and size, the case might have held, but instead has now returned to its original condition. As can be seen in the occlusal view (Fig. 28) the one on the extreme right shows a marked increase in structure between the four posterior teeth. This is not due, however, to abnormal bone growth as at first might be presumed, but to a decrease in tooth structure in the permanent dentition, for the spacing has remained the exact combined widths of the deciduous molars. Not only had the teeth decreased in size, but the second premolars are malformed in shape. As shown in my paper of last year (published in the January number of the DENTAL ITEMS OF INTEREST, and the *International Journal of Orthodontia*) internal secretions do effect the size of the teeth as well as their form, but the question naturally arises, "how we are to determine this when treatment is begun and before the permanent teeth have erupted?"

In the case of missing, or supposedly missing teeth Fig. 29 illustrates how small film radiographs might be misleading. A young man thirty-two years of age lacked a lower right permanent cuspid. Intra-oral radiographs of that locality failed to reveal the tooth. After exposing a full plate we located the cuspid lying horizontally at the apex of the second molar, as seen in the above figure.

It is not unusual to find conditions that are similar in various members of a family as will be seen in Fig. 35—three sisters, all having the upper right side occluding lingually of normal and the same peculiar rotation of the upper central incisors. (The one on the left has since lost her upper temporary molars and the permanent centrals have erupted as in the other two cases.) Another child, a boy, also shows this same tendency. Again we find that often-repeated question: "What part does heredity play in our work?"

Some years ago, a member of this society, I believe, formulated a rule, that where we find depressed, deciduous molars, especially the second, we were pretty apt to find the premolars missing. Fig. 31 shows a case in which it was presumed the second deciduous molars had been lost as there was no indication nor room for them, as seen in Figs. 31 and 32. That this rule does not hold good is indicated in Fig. 33. This radiograph not only reveals a rotated impacted premolar, but also a deciduous molar imbedded far below the gum margin.

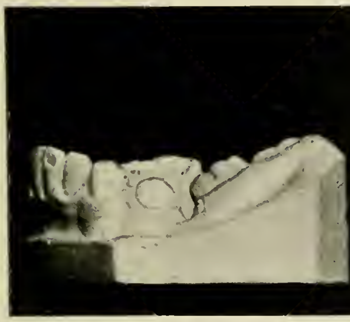

Fig. 31.

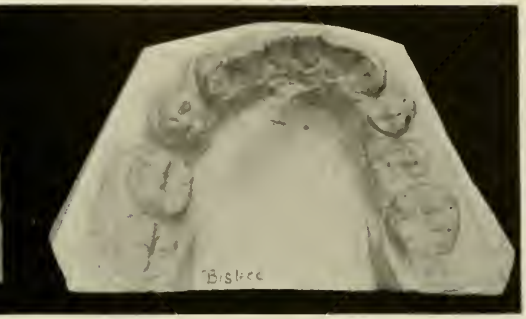

Fig. 32.

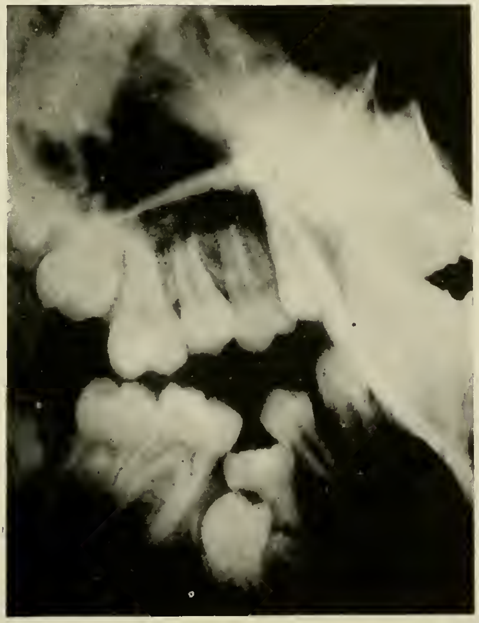

Fig. 33.

Macroglossia.

Before closing it is my desire to present two cases of macroglossia and the extreme difference as to the course each took. Fig. 34 is that of a young man twenty-two years old. The macroglossia in this patient has caused a wide separation of the anterior teeth with extremely large dental arches. A careful observation of the lower (Fig. 34) reveals not only this spacing, but also a remarkable transposition of teeth, the laterals taking the place of the centrals, better seen in the mouth than in the figure, while the left cuspid is between the lateral and the central. This case has retained the normal mesio-distal relation (Fig. 35). The father, who likewise suffers from this malady, from the mother's description, is similar in form and result to that of the son.

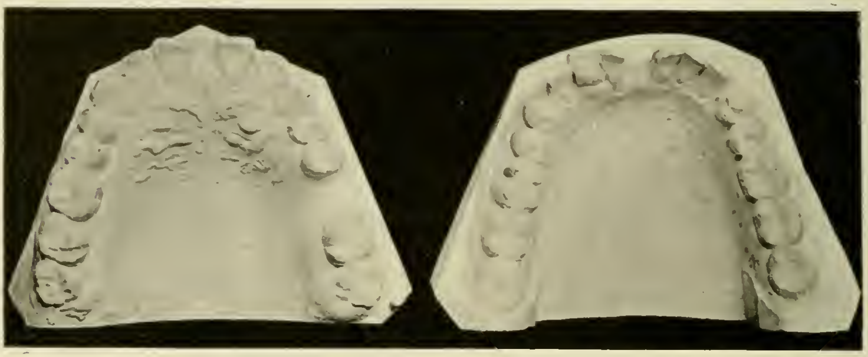

Fig. 34.

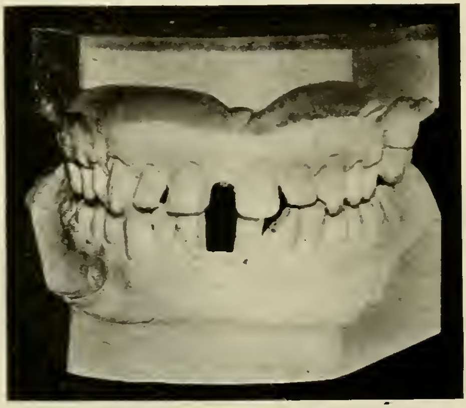

Fig. 35.

Fig. 36 is that of a child three years of age. Here the enlargement of the tongue has caused the mandible to protrude as shown by the position of the temporary cuspids, with a slight increase of bone growth between all the teeth. An extreme open bite has resulted with a retardation in alveolar development in height; yet nature is trying to do her best by holding in apposition the last three teeth on the left side. Owing to the difficulty in cleaning the teeth most of the dentin has been attacked and broken down, as shown in Fig. 37. Fig. 38 shows a radiograph of this case and the effect of tongue pressure. As the tongue is being reduced in size, by the time that the permanent teeth erupt, orthodontic treatment might be of some assistance. Fig. 39 is from a photograph of the child, showing the effect on the profile due to the inability of the tongue to remain in its normal position. Fig. 40 shows the condition of the tongue.

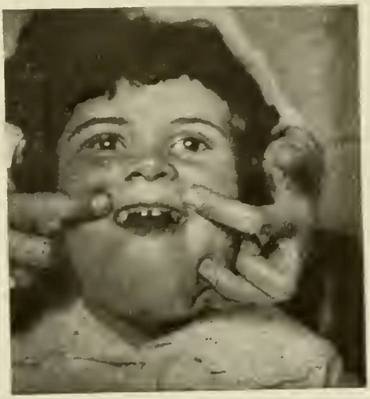

Fig. 36.

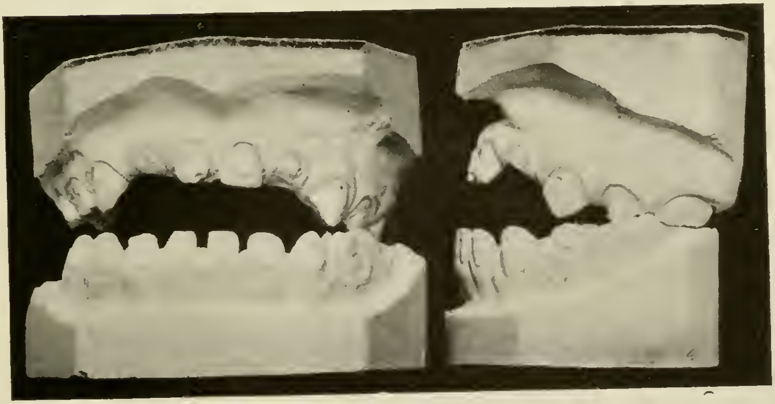

Fig. 37.

The cases presented here are but a few that illustrate abnormal conditions met with in orthodontic practice, and are still to be solved. We all have as interesting cases and as repeated requests have been made for our co-operation from associated scientists it is our duty as individual members to give these men access to such histories which they so eagerly seek. And in conclusion on their behalf I make such a request, with a suggestion that the Executive Committee gather such material from each individual member and at our annual meetings present it at a general session, in order that we may all derive benefit thereby. This material might then be transferred to some institution for scientific usage.

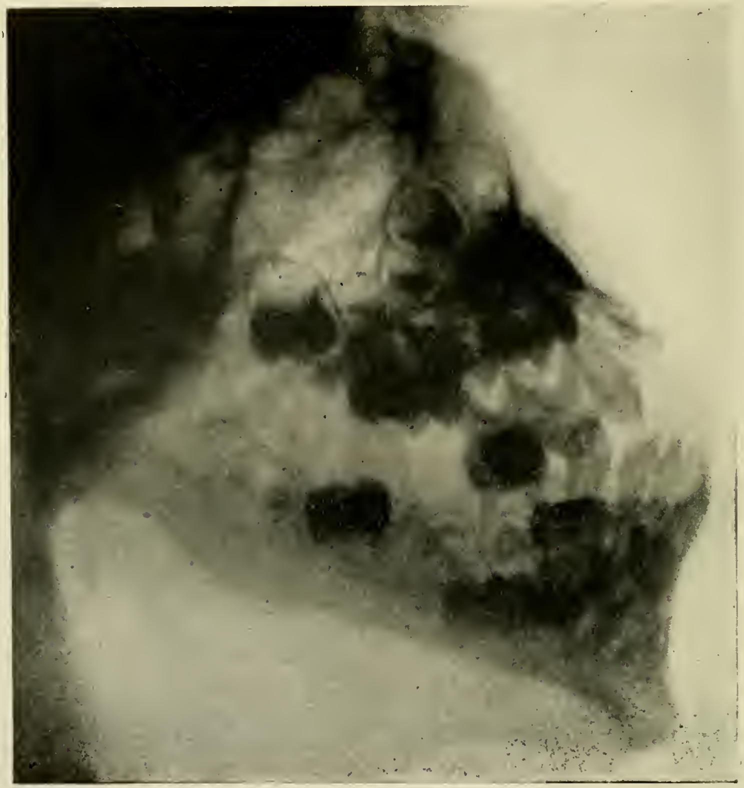

Fig. 38.

Summary.

In summarizing this paper I can only add those words found upon the cover pages of one of our foremost dental journals:

"Observe, Compare, Reflect, Record."

Observe. In observing more closely those cases in our practices, greater light, information, and truth will result.

Compare. By comparison of cases correlated facts will be observed, so that science will derive the benefit.

Reflect. Reflecting on what we have observed after a comparison of our models, orthodontia will gain as a science.

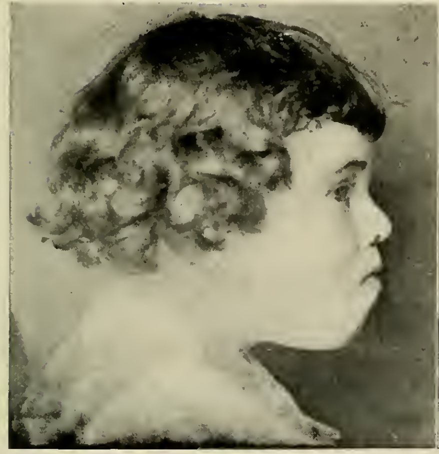
Fig. 39.

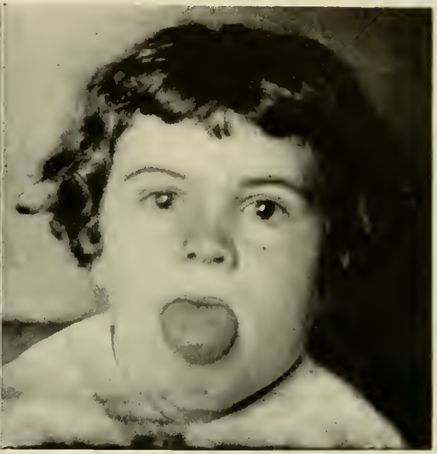
Fig. 40.

Record. Record our material for the benefit of others, as well as those in science, so that through observation, comparison, and reflection, associated sciences will then be of some assistance to orthodontia.

40 East 41st St., N. Y. City.

Discussion of Dr. Weinberger's Paper.

Dr. M. N. Federspiel, Milwaukee, Wis. Dr. Weinberger opens up a new field for research which carries me back to the days when I was taking my medical course with teachers who spoke on the subjects of club-feet and web-fingers, and it brings me back to the theory of Cohnheim, who puts it in a nutshell when he says, "misplaced embryonic cell." That is where he stops. That is as far, I think, as we can go fundamentally at present—misplaced embryonic cells. This paper offers a wonderful field for research.

Speaking of supernumerary teeth and malformed teeth, we need to go into the subject of heredity. When we speak of teeth being found in dermoid cysts, and of finding teeth in the ovaries, and we find that these dermoids contain hair and normally shaped teeth, the medical man is up in the air. That is far as he can go. I have seen a number of cases where very large cystic ovaries have been removed containing hair and normally shaped centrals, laterals, or cuspids. It is a question of pathology after all.

With reference to follicular cysts; to this day we have not been enlightened in regard to them.

As to the subject of odontomas; I believe the British Dental Society had a number of men who collaborated on this subject and wrote a book on odontomas. I think the book is published by the British Dental Society. I have it in my library. They speak of cementomas, osteo-cementomas, osteo-odonto-cementomas, etc.

The subject of multilocular cysts and dermoid cysts is confronting the medical man as well as the orthodontist, and it is up to the researchers to work these things out.

As to the internal secretions, I heard an eminent surgeon at the American College of Surgeons say that we think through our secretions. This is as far as they have gone. So these are subjects which have to be considered.

I cannot add any instructions or suggestions to this paper because I am up in the air in regard to many things. I know these things exist, that they need to be treated, but we do not know the etiology. I thank you. (Applause).

Dr. O. W. White, Detroit, Mich.

Dr. Weinberger has again brought before our society a subject which gives us food for thought along lines that open to orthodontia the greatest opportunity for progress.

The mechanical treatment in our profession, has developed to a marked degree, and as I stated in my paper on *"Tissue Growth,"* read before his society two years ago, orthodontists have great opportunity to assist and be assisted by the scientific men who are striving to work out the great and mysterious forces which control tissue growth.

The essayist has shown a number of cases where abnormal conditions have existed, and has called attention to evidence of counterbalance or compensation in tissues to offset improper development.

The great problem of internal secretion disturbance is one which the essayist says we must leave to our medical co-workers, but I wish to call your attention to the fact that the orthodontist has many opportunities to assist in observations of patients, suffering from these disturbances, and as any advancement in treatment or knowledge of conditions would be of great value to us, we should all strive to do our share in securing data along these lines.

We are in a position to offer our allied scientists some very valuable information regarding tissue response to mechanical stimulation, which should be of great value to students of life processes.

When we have more definite knowledge as to vital forces governing tissue growth the orthodontist can enter upon a new phase of orthodontia practice which will be preventive measures of a nature that will be of untold value to humanity.

However, at the present time, we are a long way from the goal, although the new physiology as advocated by Haldane, of Oxford, is a step forward; it concerns itself with the study of normals; how they are related to one another; how they react on or are affected by other "normals"; their relationship to environmental conditions and so forth. It is not biophysics or biochemistry, but is biological physiology. The attempt to interpret living organisms in terms of physico-chemical laws is judged as having been "the most colossal failure in the whole history of modern science."

Dr. Weinberger's recommendation that members of this society, "observe, compare, reflect and record" to a greater extent is very timely, and I trust that we as individuals, and as a society will heed this advice which will surely be of great value.

I wish to thank the essayist for this presentation of his paper, and I hope we will have a number of such papers which will stimulate thought along these lines with the hope that in the very near future we will have some definite knowledge which will be of value in our practical work.

Dr. Weinberger. I have merely touched on certain interesting material found among our varied collection of cases, offering no solution to the problems, as I believe that is beyond our ability. However, I thought that in presenting these cases it might act as an incentive to others and when a sufficient number have been obtained, other scientists might then be able to solve these questions for us.

Perhaps it may be true that we think with our internal secretions, at any rate one thing is certain, that is a great many men who have brains never use them, or let us say, never allow them to be stimulated. In many cases not knowing just what are the exact functions of the endocrine organs, it might be proper to put the responsibility upon those same organs that are not being blamed for practically half of our illness.

I thank you.

Correction.

Dear Dr. Ottolengui:

In my paper, "Democratizing Dentistry," published in Dental Items of Interest for November, I gave Dr. Fones credit for work done by Dr. Keyes. With apologies to Dr. Keyes, I would like to make this correction.

Sincerely yours,

March 14, 1919.

Allen H. Suggett.

THE AMERICAN SOCIETY OF ORTHODONTISTS

NINETEENTH ANNUAL MEETING
HELD AT
ST. LOUIS, MARCH 10, 11, 12,
NINETEEN HUNDRED NINETEEN

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THE AMERICAN SOCIETY OF ORTHODONTISTS

NINETEENTH ANNUAL MEETING
HELD AT
ST. LOUIS, MARCH, 10, 11, 12,
NINETEEN HUNDRED NINETEEN

Dates and Places of Meeting of The American Society of Orthodontists.

First Annual Meeting held at St. Louis, Mo., June 11, 12 and 13, 1901.

Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30, and October 1. 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908

Ninth Annual Meeting held at Cleveland, Ohio, October 4, 5 and 6, 1909.

Tenth Annual Meeting held at Denver, Col., July 13, 14 and 15, 1910.

Eleventh Annual Meeting held at Boston, Mass., September 20, 21, 22, 23, 1911

Twelfth Annual Meeting held at Chicago, Ill., July 1, 2 and 3, 1912.

Thirteenth Annual Meeting held at Chicago, Ill., June 30, July 1 and 2, 1913

Fourteenth Annual Meeting held at Toronto, Canada, July 2 and 3, 1914.

The regular 1915 meeting was abandoned in order not to interfere with the section on Orthodontia of the Panama-Pacific Dental Congress, held in San Francisco, Cal., August and September, 1915.

Sixteenth Annual Meeting held at Pittsburgh, Pa., July 20, 21 and 22, 1916.

Seventeenth Annual Meeting held at Excelsior Springs, Mo., September 5-8, 1917.

Eighteenth Annual Meeting held at Chicago, Ill., Aug. 1, 2 and 3, 1918.

Nineteenth Annual Meeting held at St. Louis, Mo., March 10, 11 and 12, 1919.

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American Society of Orthodontists.

President's Address.

By Oliver Wilson White, D. D. S., D. Sc., Detroit, Mich.

It is my privilege to address you, as president, at this, the nineteenth annual meeting of the American Society of Orthodontists.

To our guests and friends I extend a most hearty welcome from the society.

It would seem but fitting at this meeting in St. Louis that I should adhere to the proverbial custom of presidents of scientific and arts societies, of reviewing the past achievements, and I might say "mischievements" of our academy. However, as we are to enjoy a paper by Dr. Weinberg covering the period of existence of this society, giving an index and classification of work, in order that there may be no duplication, I shall make a comparison of the president's address on the morning of the first meeting and conditions existing on the opening of the present meeting.

Tribute to Dr. Edward H. Angle.

I cannot refrain from paying tribute at the outset of my remarks to Dr. Edward H. Angle.

To Dr. Angle is due the credit not only for the organization of this society, but for the teaching of the first men who entered the specialty of orthodontia.

We who were privileged to attend the Angle School of Orthodontia in this city can well recall the sacrifice of time and energy that Dr. Angle gave for the promotion of orthodontia, and it is a great personal regret, which I am sure you all feel, that we cannot have Dr. Angle with us at this meeting, that we might show our appreciation and gratitude for what he has done for this society and its members.

Dr. Angle's views as to the future of orthodontia were expressed in his address at the first meeting of this society in 1901, and they show the clear conception which he entertained of the future need of developing orthodontia as a specialty.

In opening the meeting he said: "This morning marks another epoch in the history of science, the opening of the first meeting of the

Reprint from Dental Items of Interest,

Society of Orthodontists, a society organized for the promotion and exaltation of that branch of dental science known as orthodontia, and looking to the early and complete recognition of this branch as a distinct specialty, to be taught and practiced as such.

"Doubtless it would not be inappropriate for me at this time to set forth the reasons for the organization of such a society, for unless there be good and valid reasons for its establishment, its course must be marked by an unhealthy and unprofitable existence, and probably an early dissolution. On the other hand, if there be good and sufficient reasons for such a society they should be known and recognized by the lovers of all branches of medical science, and the sympathy and assistance of all enlisted, that the greatest degree of benefit may be conferred, not only to the science of orthodontia, but to humanity at large, to whose welfare all laws enacted, and all societies organized owe their first duties. Hence, I shall endeavor to set forth some reasons why this organization should be founded, and why I believe this meeting marks the beginning of something so grand, so noble, something destined to so elevate dentistry in general and so greatly benefit humanity, that even we who are assembled here this morning do not dream of its full importance, though we, as founders, are most interested, and our hearts beat highest in enthusiasm, anxiety, and love for this branch of science, and the success of this, the first meeting."

To prove Dr. Angle's predictions of the success of orthodontia as a specialty, I wish to call your attention to the wonderful progress and growth during the existence of this society. Three years after the organization there were only seven orthodontists in the country. Today there are several hundred practicing this specialty, and its field of usefulness has attracted very broad attention. A progress, I am sure, which reflects great credit on the judgment of the organizers.

Not only have the orthodontists increased rapidly in number, but we have several orthodontic societies, which are doing very valuable work in furthering the cause of orthodontia. That orthodontia has elevated dentistry is reflected by the inspiration given by members of this specialty to the formation of different specialties in dentistry. I refer to the periodontist, the exodontist, the prosthodontist, and the radiodontist.

Dr. Angle spoke of the history of orthodontia up to that time, following with a paragraph on the lack of knowledge of this subject, from which I quote the following:

"While the demand for general operations in dentistry is supplied with as high an average of skill perhaps as any of the branches of the arts or sciences, the same cannot be said of orthodontia, for notwithstanding the fact that malocclusion, with all its baneful effects, has grown to be almost the rule, instead of the exception, only the merest fraction of those needing attention are receiving it, and even such treatment as is meted out is of such a nature as to leave but little doubt in the mind of the careful investigator that more blunders are committed than successes gained, and that in a heavy percentage of cases more injury has been done to the dental apparatus as a whole than benefit conferred, to say nothing of the frequently severe tax unnecessarily inflicted upon the entire physical economy of the patient."

Regarding the above paragraph, the only comment I would like to make is that to-day the conscientious dentist does not attempt the correction of cases unless specially qualified to do so, and treatment of orthodontic cases is rarely carried on in connection with the successful practice of general dentistry.

Orthodontic Appliances.

Regarding appliances, Dr. Angle had this to say: "Some of them are marvels of ingenuity and skill; others absurdly complex, most unsightly, crude and inconvenient in the extreme; as inefficient and faulty in principle as it is possible to imagine and made to operate in direct violation to many of the true physiological requirements of tooth movement and hygienic conditions incident thereto. They are produced in ignorance and operated in ignorance, and the results are familiar to all, yet our current literature still teems with them."

In no other channel has orthodontia developed to the extent it has in producing efficient, esthetic, and prophylactic appliances for orthodontic treatment. It is impossible for me to trace the wonderful progress our profession has made along this line, as time will not permit of my recording this history.

Unfortunately, we still have with us the commercial orthodontist (if such a term is proper), who advertises his wares and knowledge for sale to the dental profession. However, they are very few in number, and the members of the profession, as they become enlightened realize that orthodontia will never be successfully included in the curriculum of a correspondence school.

In contrast, the attitude of the dental profession towards orthodontia in 1901 and 1919 is very marked, and it might be of interest to review the questions Dr. Angle asked on the morning of our first meeting.

Queries by Dr. Angle and Comments Thereon.

"Why is it that so little really good work is done in orthodontia, in proportion to opportunities and importance?" This may be true to a certain extent to-day, when we consider the proportion and opportunities offered, but the exceptionally high-grade work accomplished in all of our large cities to-day by members of this specialty is very gratifying, and time will soon grant everyone the opportunity of having proper orthodontic treatment when required.

"Why is orthodontia in practice but a side issue to all other operations in dentistry?" This is not the condition today, and to the founders of this society is due the credit for changing this condition. The members of the dental profession have, through the teaching and clinical work of the orthodontists, come to recognize the value of occlusion as the foundation of all dental operations and upon orthodontists as guardians of occlusion.

"Why are the discussions of papers on orthodontia so lamentably weak; usually confined to the discussion of peculiar regulating appliances, or tedious descriptions of so-called rare cases?"

To-day the reference to orthodontic appliances is very rarely made at a dental meeting, but, on the contrary, very intelligent discussions on occlusion and the value of early orthodontic treatment, for the establishment and preservation of occlusion, are often met in dental literature.

The advice given to parents regarding correction of malocclusion by general practitioners of dentistry is very different to-day from what Dr. Angle stated that morning. It is very gratifying to note in recent years the increasing number of young patients seeking advice and treatment for malocclusion in its early stages of development. In fact, preventive measures in all branches of the dental and medical science have progressed so rapidly that consultation for early diagnosis is proper and common practice to-day.

Our president in 1901 said: "The answer to all these questions seems to me plain, and should, as we think, be apparent to all, even to casual investigators. It is that orthodontia is a great science by itself, with requirements in its study and practice so radically unlike that of other branches of dentistry that the two can never be profitably combined either in study or practice. Each seriously handicaps the other, and orthodontia naturally suffers most, for the reason that it is wholly unlike other operations in dentistry. It is therefore least understood, least studied, and made secondary, alike in dental colleges, in practice, and in dental societies. Hence, it is not unlikely to follow that in proportion as a dentist is successful in other operations of dentistry, he will naturally be less successful in those of orthodontia, for in that same proportion he will have less inclination, less time, and less energy to devote to it."

Under the heading, "Orthodontia as a Separate Science," he spoke as follows: "Orthodontia has been revolutionized, and we would ask those who may doubt the practicability of this specialization of orthodontia to but reflect on the marvelous advancement which has been made in the various branches of medicine through specialization, not to mention the growth of nearly every other branch of science and art accomplished by the same power. Indeed, this is the very age of specialization, and was there ever such an age of progess? Wise is he who recognizes the natural and resistless power of specialization, and narrow indeed must be he who is blind to its demands and attempts to resist its might.

"So we must work patiently, and wait, and believe that orthodontia, so replete with possibilities for improving the health and the happiness of orally deformed humanity, and for uplifting the highest phase of art, or that of improving the lines of beauty, and that, too, not applied to the cold, unresponsive lines of marble, clay or on canvas, but to the living, divinely patterned human face, will and must be a firmly established and useful specialty of dental science, and if this is inevitable, as I believe it is, then it is fitting and proper that this society should be established, for our best efforts can only yield the best fruit in strong, earnest, sincere, concerted action."

As we look back to-day and take into consideration the different impulses of progress in orthodontia, we realize that this success could never have been attained had not orthodontia been divorced from the general practice of dentistry. The men who made this progress possible were not "cranks," as a president of the National Dental Association stated, but were men of high ideals, concentrating their efforts to correct malocclusion, one of the chief factors in the destruction of the human mouth, and the great value of orthodontic treatment to-day is being more and more appreciated, showing that a great many of the hopes and predictions that were entertained by those pioneers who left the meeting, thrilled with ambition to place orthodontia in its proper sphere of dental and medical science, have been fulfilled.

It must be a great source of satisfaction to the early members of this society, to feel that our progress has been uninterrupted by personal ambition or politics, and may I impress upon the members to-day the necessity for keeping up our sincere, broad, liberal, and honest efforts, that our progress may continue, as we are but a young profession, with a great many avenues opened for advancement.

In conclusion, I wish to carry out a request of our first president, who said: "In the deliberations of this society, now and hereafter, let us not forget the debt we owe to many noble men who have worked so earnestly in this our chosen field, and who though often seriously hindered, have assisted in developing orthodontia."

He mentioned with tender reverence the names of Drs. Fauchard, Schange, Fox, Harris, Westcott and McGill; and the living, shining lights in orthodontia in those days were Kingsley, Baker, Guilford, Brady, Case, Matteson, Jackson, Farrar, Goddard and Ottolengui. To the list I wish to add the names of Presidents of this organization and some of the men who have contributed to orthodontic literature and technic.

I thought it might be of interest to throw upon the screen as many slides of these men as it was possible for me to obtain. (Dr. White then exhibited portrait slides of the following):

Dr. Edward H. Angle (first president), A. W. Kingsley, J. N. Farrar, S. H. Guilford, V. H. Jackson, Henry S. Baker, R. Ottolengui (president 1906), Calvin Case, Milton T. Watson (president 1903 and 1912), Lloyd S. Lourie (president 1904), H. A. Pullen (president 1907), C. A. Hawley (president 1908), F. M. Casto (president 1909), B. F. Gray (president 1910), A. P. Rogers (president 1911), B. E. Lischer (president 1913), Guy S. Hume (president 1914), M. N. Federspiel (president 1917), D. W. Flint (president 1918), J. L. Young, Martin Dewey, Fred S. McKay.

Discussion on the President's Address.

Dr. C. M. McCauley, Dallas, Texas.

We have had the pleasure of listening to a most excellent address, which contains sufficient texts for a number of sermons. In fact, I have never heard an address delivered by a president of this association that did not contain texts for a great many sermons which should be preached not only to the members of this society but to the entire dental profession.

The unfortunate thing with reference to the proceedings of this society is that they cannot reach the entire dental profession, not because the average general practitioners need the knowledge that is here disseminated, to use in their own practice, but because they need to know that it does not belong in their practice.

I have jotted down three points on which I expect to base the few remarks which I have to make. The first is "education," upon which the president dwelt at length in his address. The second is "prevention," which he has also touched upon, and the third, "association," in which all of us should be interested.

Education as Related to Orthodontia.

So far as education is concerned, you will all agree that it is one of the great handicaps with reference to the specialty of orthodontia. The country practitioner, the rural man, is not as a rule educated in orthodontia, and in many cases he is not sufficiently educated to know that he is not educated in orthodontia. In many instances the patients who fall into their hands suffer. The average man who follows general practice has no right to try to follow orthodontia, and one of the burdens of this society is to teach the young man that if he is engaged in general practice he cannot successfully follow orthodontia as a specialty. The field of dentistry is too large for any man to master it all. At this time it is divided into six or seven specialties, and the next problem is the training of men for these six or seven specialtiees.

Since there has been a four-year course for dental colleges in this country, I have advocated the full dental course for three years; that is, three years devoted to general dentistry. During that time the student should be given a general idea of the whole of dentistry and should be studying his own qualifications, his own adaptability. His teachers can be helping him to make a study of himself and to determine what particularl ine of dentistry his qualifications will best fit him for.

The fourth year should be devoted entirely to training that man in whatever specialty he is best adapted for. You as orthodontists know that there are few men, if any, who possess sufficient qualifications to undertake orthodontia and practice other specialties of dentistry and do them all well. So if the young man learns in the early part of his career the line of work he is best adapted to, a long step toward a successful career will have been made. If it be teaching, let him devote himself entirely to teaching the science of dentistry. If it be orthodontia, operative dentistry, presthodontia, bridgework, or periodontia, let him learn early in his career that this is what he is fitted for, and that he should devote his time to that work to become a real specialist in that line. I believe none of you will question the fact that the clientele that happens to come within that man's reach will be bettter off than they would have been had he gone on and tried to master and cover the whole field of dentistry. Of course, these remarks only apply to the man that is now a student and those who are yet to begin the study of dentistry. The situation as it exists among the practitioners in the dental profession today also needs attention.

The man who comes to the city from a rural district, to take a short course which he calls a post-graduate course, goes to a school where the whole curriculum is covered in thirty days. As a matter of fact, no school can cover a curriculum like that in an efficient post-graduate course in thirty days. It seems to me, post-graduate courses could be vastly improved if every school had six schools within itself. For instance, the Washington University, headed by the dean of the institution, with the School of Orthodontia, headed by a man recognized the country over as a specialist in that particular line, and so on through the entire list of specialty schools. When a man comes for a course of post-graduate instruction, let him take whatever courses he prefers; let him spend six weeks or two months in studying a particular line of work. If he wants another course, let him remain longer in the same school. Throughout the five or six different specialty courses that man can stay long enough to get what he wants, learning what he can do himself efficiently as well as learning what he should refer to the specialist. A post-graduate course for the general practitioner arranged after that plan would be an improvement over the post-graduate course which is given in thirty or sixty days' time. The general practitioner who wishes to specialize should take the fourth year, or specialty year, in the regular course, if laid out as referred to above.

Orthodontia as a Prophylactic Science.

I have a vision of a time in the future when orthodontia will not be practiced so much as a corrective measure, but will be more in the line of prevention. I look for the day to come when possibly orthodontists will begin to receive these cases for treatment in the embryonic stage by attending to the mother's diet and keeping the life forces at the highest pitch in the mother, and if possible, arranging so that food given to the child may be natural food. The natural food the child may get during its infancy and younger days will certainly have a wonderful influence upon the development of the teeth and bones. The little fellow of four or five years who has not received this attention, who has not had the proper nourishment, may not have the mandible developed, as shown by failure of the temporary teeth to space properly between the ages of four and six years.

This is the age and now is the time when the general dentist ought to know that something should be done to stimulate proper development. Instead of that, the rural dentist perhaps never sees the child until the second teeth come into place, or out of place, and then, nine times out of ten, he advises the parents to wait until the child is twelve or fourteen years of age. The rural dentist needs education sufficient to teach him when the proper time for development of the mandible has arrived, and if spacing does not occur that it is important that he should send the child to a specialist promptly, before malocclusion really appears. The educated orthodontist will supply the forces which the vital functions of the child have failed to supply and the permanent teeth may be directed into proper place with less difficulty.

Value to Orthodontia of Association.

I have appreciated for several years the good work this society has been doing. The product of this society has been confined too closely to its membership; others have not profited as they should by the work you men have been doing. You know that in the last generation, and especially in the last few years, yes, the last few months, questions have ceased to be local ones; that matters have ceased to be local matters; that things have taken on not only a national but an international phase; in other words, a world-wide phase. If we teach things in this society which are good for us and good for the small percentage of humanity with whom we have come in contact, they should be just as good for the rest of the race. I do not doubt that I speak the truth when I say that this society is one of the leading societies in its line, and if that be the case, would it not be well for the product of this society to be distributed over more than a local territory?

We have nations to the south of us whose interests and needs are the same as our own. The science of orthodontia is younger and less advanced than in our own country, and it has seemed to me for many years that in view of the rapid progress of dentistry and the dental specialties in this country, it would be a good thing from the standpoint of learning and fraternalism, for societies of this character in this country to invite the countries south of us to send representatives to meet with us. I have had some correspondence with some of the men in those countries, and I am sure they would be delighted to receive an invitation from us to send reprensentatives and join their forces with ours. Some of these men would become valuable members, and the sum total of their labors added to our efforts should result in greater blessings for us all and should add glory to our cause in the Western Hemisphere.

Dr. Wm. C. Fisher, New York City.

I remember Dr. Kells last year in Chicago, in answering Dr. Ottolengui's remarks made in the discussion of his paper, said to him when he got through: "I don't care what you say, Rod; you are wrong." There was one point in the remarks of the gentleman who has just preceded me of which I can say, "I don't care what he says; he is wrong." He is wrong because he never was right. When a gentleman says that a general practitioner of dentistry has no right to practice orthodontia, he is wrong, because he never was right. He has a right to practice orthodontia if he wishes, just as much as any so-called specialist. In fact, he is legalized to practice it in every State; yet we hear the statement made so frequently, "He has no right to practice orthodontia," that it is coming to be an abomination to human intelligence. The point is this: The general practitioner of dentistry may not be *qualified* to practice orthodontia, but he has the *right* to practice it, and if he is not qualified to practice it, the fault lies with the educational curriculum. And this society, as I stated last year and the year before, must share its portion of the responsibility if the general practitioner of dentistry is not qualified to practice it. But let us stop saying that these practitioners have no right to practice orthodontia, because it makes them dislike us instead of coming to us for knowledge or enlightenment. Let us impress them with the fact that they are not qualified to practice it, and that we are willing to teach them. Then they will come to us.

I agree with a great deal that has been said in reference to postgraduate work. Our Educational Committee should thank the gentleman for giving us many suggestions we can use in our committee report, which we have not been able as yet to compile.

He speaks of the fact that the rural man, the man living in a small district, should be educated. First of all, he makes the statement that the general practitioner has no right to practice orthodontia and then he says he should be educated (with which I agree), but you cannot educate him in a specialty just far enough to convince him that he cannot practice that specialty. You say, educate him far enough to be able to differentiate cases so that he may send them to you. That, I fear, will never come to pass. I take it, when a man comes to you from the rural district, he looks to you for education and enlightenment in the modern science of orthodontia in order that he may practice it, and if you do not hold out to him the possibilities and prospects of practicing that specialty, he certainly will not come to you for knowledge. He may come to you for knowledge and gain sufficient of it to convince himself that he is not qualified to practice, but you cannot give him a smattering of education and expect to convince him that he is not qualified to practice something. Qualify him, and he will then know his own limitations.

A Removable Retainer.

By C. A. Hawley, D. D. S., Washington, D. C.

At a meeting of this society in Chicago, July, 1918, in the course of a discussion of Dr. J. V. Mershon's paper, I incidentally mentioned a removable retaining device which I had been using with some success. My further experience with this retainer has been so gratifying that I now feel justified in presenting the matter more in detail.

The McBride Retainer.

As I stated at the time, my first ideas of the retainer were gained from Dr. R. D. McBride of Dresden, Germany, while visiting his office in 1906. He had been using a form of retainer for several years which embodied certain basic principles, the value of which impressed me very strongly.

This device consisted originally of a rubber roof-plate with heavy flat bars of metal passing between the first molars and second bicuspids to the buccal surface. These bars on the buccal surface were fashioned into planes which slid back of similar planes on the lower apparatus for the purpose of holding the proper mesio-distal relation of the two jaws. A piece of 17 ga. round wire extended around the outside of the arch in contact with the labial and buccal surfaces of the teeth and was fastened at either end to the bars which passed between the teeth as

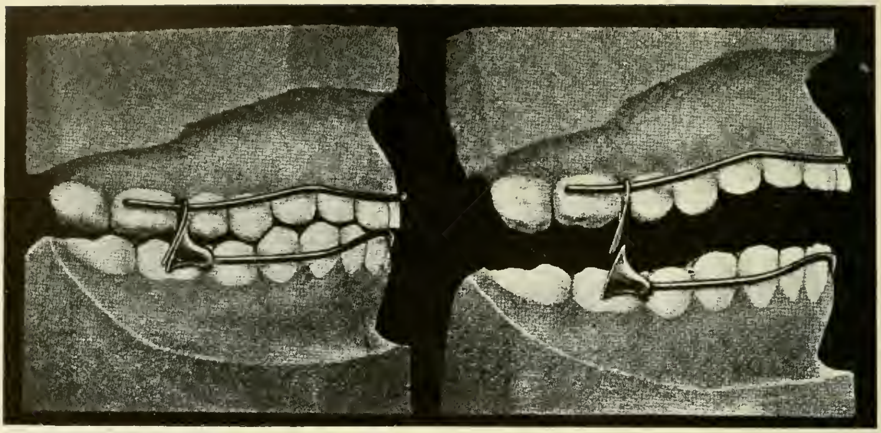


Fig. 1.

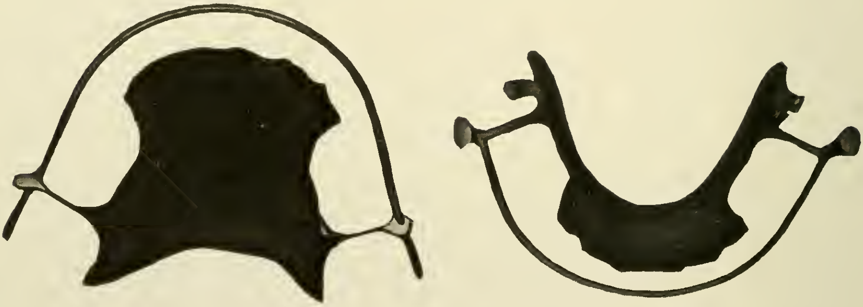


Fig. 2.

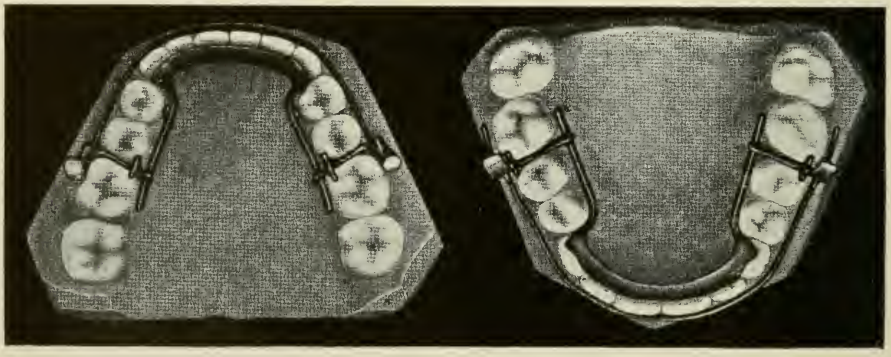


Fig. 3.

previously mentioned. (Figs. 1, 2 and 3.) He used also in some cases, instead of a roof-plate, a very heavy wire bent to the lingual surface of the teeth as shown in the illustrations.

The retainer as made by Dr. McBride was never very successful in my hands yet I have considered the principles upon which it was based so promising that I have persisted in its limited use and study since that time. One after another the most objectionable features have been eliminated, until now I have great confidence in its practicability and have used it almost to the exclusion of everything else for a couple of years.

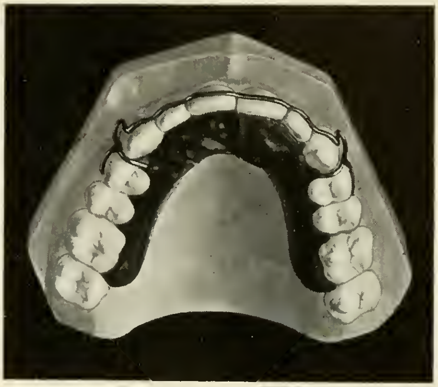


Fig. 4.

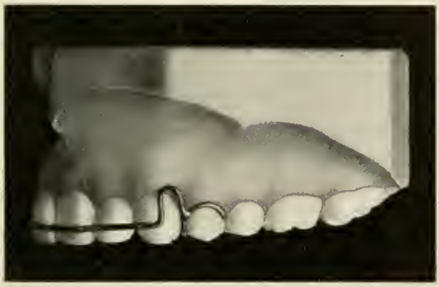


Fig. 5.

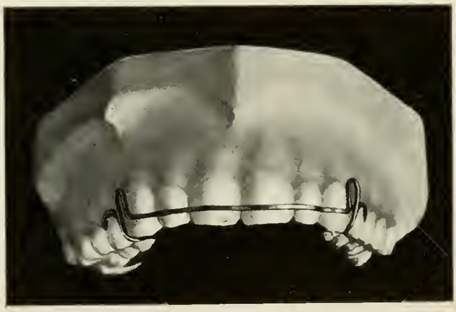


Fig. 6.

Objections to the McBride Retainer.

It is hardly necessary to enumerate the obvious objectionable features of this original appliance, yet it might not be out of place to mention some of them.

First, the wide spaces necessary between the first molars and second bicuspids were often troublesome. Food often became packed in a pocket under the bar and often the bar was pushed down further than intended through the breaking or displacement of the stops. Then, if the appliance was left out a few days, the spaces would close. This possibility prevented a most important final use of the retainer which will be described later.

Second, the side planes for holding the mesio-distal relation I found successful in only a few cases. With our present understanding and practice, I think they are wholly unnecessary.

Third, the labial wire was too heavy and had too long an extension without supports.

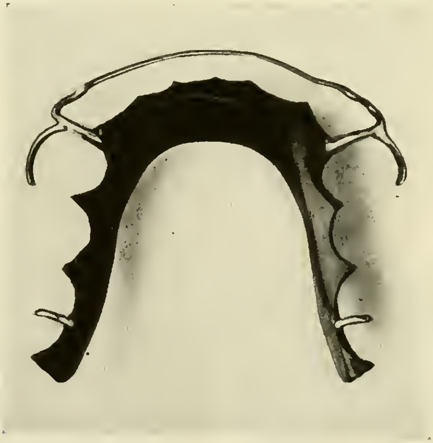


Fig. 7.

The Hawley Removable Retainer.

The retainer, as I am now using it, consists of a skeleton plate fitting accurately the lingual surfaces of the teeth. From the plate, back to the cuspids, where there are always spaces even in closely occluding dentures, passes a 19 ga. gold wire, which is formed into loops, and between them, passing over the labial surfaces of the incisors, is a flat wire .022 x .036. Attached to, and extending backward from the 19 ga. wire is a bicuspid clasp. (Figs. 4, 5, 6.) On the lower a wire hook is imbedded in the plate and passes between the lingual cusps of the first molar over the margin of the tooth to keep the plate from being pressed down at the heels. (Fig. 7.)

If it is desired to correct or hold the overbite a flat ledge is built on the upper plate. This can be extended into a bite-plane to assist in correcting or holding the mesio-distal relations where it is needed. (Fig. 8.)

Necessary Factors in Retention.

There are four important movements that must be provided for in retention:

First—The expansion and form of the arch.

Second—The rotated teeth must be prevented from returning to their former positions.

Third—The mesio-distal relations must be maintained.

Fourth—The overbite must be established.

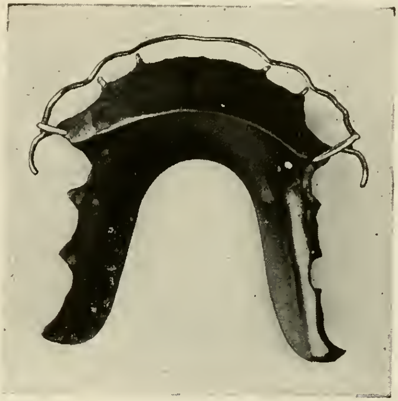


Fig. 8.

As for the first, the holding of the expansion and form of the arch, the efficiency of a plate needs little comment. It is one of the oldest and most reliable means used for that purpose.

Retention of Rotated Teeth.

As for the second, the retention of rotated teeth, the possibility of this method most aroused my interest in Dr. McBride's appliance and I might say my skepticism as well. However, I may say that I am now succeeding better in holding such teeth by this method than I have by bands or spurs or any other method I have ever employed. By glancing again at this device (Fig. 4), it will be seen that in order to rotate, a tooth must lift away from the plate which closely fits the palatal surface. This the labial wire prevents it from doing. If a tooth is seen to start in this movement, the wire may be made to press harder at this point, the tooth will return to place and the movement will be stopped. The question might naturally arise, why the device succeeds while lingual and labial wires combined, soldered to cemented cuspid bands, are generally a failure in preventing incisor teeth from rotating. The reason probably is that no wire has been made to fit the lingual surface as accurately as does the plate and would not be safe from injury to the tooth, if it were not removable, even though it were so fitted. Also the labial wire in such a cemented device has not the same elasticity or adjustability.

There are some exceptions to be made to the teeth that may be held from rotation with this retainer. Round or commonly called peg-shaped lateral incisors or lower bicuspids for obvious reasons cannot be retained by this means. For the latter I use a cemented band with a flat vertical bar attached, which fits into a slot in the plate (Fig. 9). To hold the second bicuspids when rotated, it is necessary to extend the bicuspid clasps over these teeth (Fig. 10).

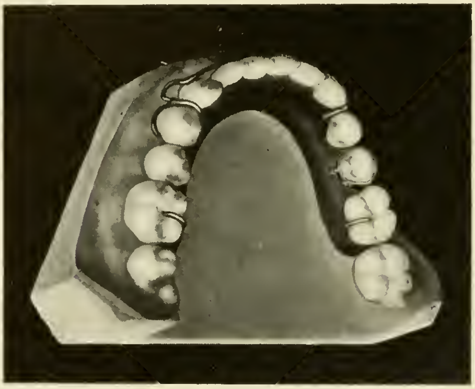


Fig. 9.

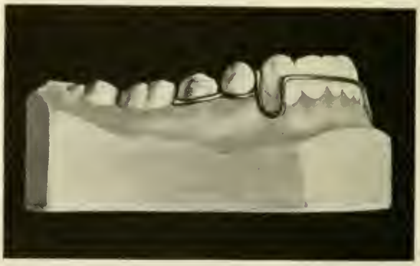


Fig. 10.

Retention of Mesio-Distal Relation.

As to the third, the mesio-distal relation, this has been one of the most troublesome problems in the development of this retainer. The use of intermaxillary rubbers with a removable fixture is impossible unless some bands are used to make it semi-fixed, and these bands seriously detract from the perfection of the retainer. However, I have found that if the arches are so harmonized that the forward and proper occlusion is the only comfortable one for the patient, and all interfering cusp relations are corrected, and we utilize the muscle exercises developed by Dr. Rogers, we will have very little if any need for former methods of retaining this relation. In extreme cases, as previously mentioned, the old form of bite can be constructed on this plate and gradually removed as it is found that it is no longer needed.

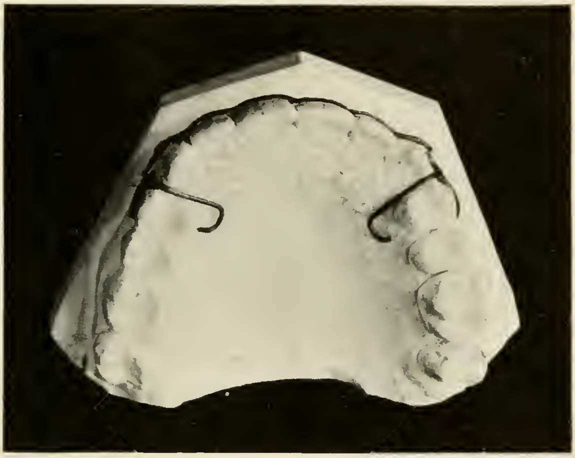


Fig. 11.

Correction and Retention of Overbite.

Fourth, the overbite is retained and can be corrected by building on the plate a flat or slightly inclined shelf back of the incisors.

The method of construction is very simple. The wire frame work is made on a model of plaster or artificial stone. (Fig. 11). These I have bent by hand with bending pliers. The wire, imbedded in the plate and up to the end of the loops is 19 ga. clasp gold or Ney's "E" wire. The portion from this point passing over the labial surfaces of the incisor teeth is flat or ribbon wire .022 x .036, the size of Angle's ribbon arch wire. I prefer Ney's "E" wire for this also. The union is made with 18 karat solder. The flat wire is slightly festooned to fit the labial surface of these teeth. Extending backward from the loop is a bicuspid clasp, soldered to the loop. This is 19 ga. "E" wire. The convex form shown in the illustration has been very successful. It is important that it should pass over the bulge of the bicuspid with some spring and lie at rest, without tension, near the gum line. After the frame work is finished the plate is waxed up and vulcanized.

It is essential that the rubber plate should be as tough and springy as possible. The waxing should be accurately done, without surplus and vulcanized between two sheets of No. 60 tinfoil. The plate, where it comes in contact with the lingual surfaces of the bicuspids and molars, should be thin so as to spring over their convex lingual surfaces and thus assist as much as possible in holding the plate in position. (Fig. 12.) The use of a rug-a-pack to reproduce the natural rugae of the mouth adds materially to the comfort of the plate.

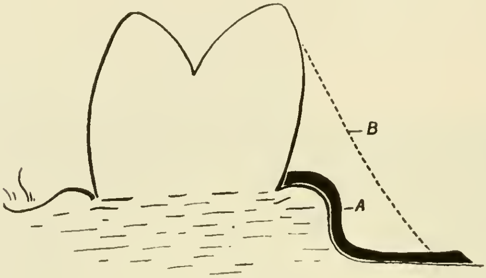


Fig. 12.

Vulcanite Preferred to Metal Plates.

After making ten gold plates, both cast and swaged, I have abandoned them altogether and replaced every one with rubber plates. They were preferred by the patients on account of the lightness and by myself on account of the greater simplicity of construction and ease of changing the part in contact with the tooth. One idea that I had was that the wires could be repaired more easily when broken with the gold plate, but I find that by using a strip of wet cotton in contact with the rubber held with a pair of pliers, the wires can usually be repaired successfully on the rubber plate.

Use of the Hawley Retention.

My scheme for the use of the retainers is as follows: they are only used when the denture is complete, that is when there are no deciduous teeth remaining in the mouth. When the case is ready for retention, I take the impression, make the plate and fit it carefully in the mouth, adjusting the labial wire so that it is in contact with each tooth. A piece of floss silk passed between the wire and the teeth will help to determine this fact. The patient is instructed to wear them constantly, removing them only for cleaning and, if necessary, while eating. They should be examined in a few days or a week and any small adjustments made that are necessary. They are worn constantly for two to six months, during which time they should be occasionally examined. If, during this time the patient wishes to remove them for a few hours for some special engagement, it can be done without harm. After this period, I have found that wearing them at night only is sufficient. Prophylaxis treatments or filling operations can, of course, be done without interference at any period of the retention. It will be understood that if there is a bite-plane, its work must be finished and the molars and bicuspids must be in close occlusion before the constant wearing is abandoned.

After they have been worn at night for about a year they can be left out for several days or a week and then tried in. If they bind or go in hard it is evident that the teeth are changing and the nightly use must be resumed. The patient can thus keep the plates for years as a check against retrograde movement and we have a provision for the different lengths of time that different cases need retention. This important feature could not be utilized in Dr. McBride's retainer on account of the closing of the spaces between the first molar and second bicuspids. In some cases of patients going to foreign countries I have two sets made to be used in case of loss or breakage.

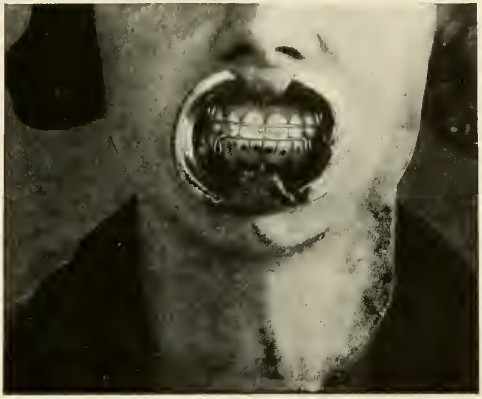


Fig. 13.

The appearance in the mouth is not displeasing (Fig. 13), in fact much less so than most fixed retention. Where teeth are missing from any cause they can be satisfactorily supplied during retention by attaching to the plates.

A considerable amount of movement can be accomplished with this retainer. Either arch can be expanded a small amount by heating in the center, stretching and then cooling in that position. The position of a tooth that is labial to the proper line can be corrected by cutting back the plate with a small stone, being careful, however, to preserve the form of the lingual surface, then adjusting the labial wire to press upon the tooth. Teeth that are slightly lingual can be moved out by cutting a recess in the plate and building on cement, amalgam or fusible metal. Thus, if in an emergency it is necessary to retain before the teeth are quite in a satisfactory position, it can be done and the final movement accomplished later.

If the teeth are in place at the time the impression is taken, no fear need be experienced for the slight movement that will take place during the few days that will elapse while the retainer is being made. Wearing the retainer a day or two will bring them back to the positions they occupied when the impression was taken.

In conclusion I wish to say that no claim whatever is made in this retainer for originality or invention. It is a new adaptation of some of the oldest things in orthodontia. Its development has consumed considerable time and thought, but the relief from the uncertainties of fixed retention in my own practice has been ample compensation. I have no idea that it is perfect or cannot be improved, but am offering it to the society with the hope that many helpful suggestions will be made.

Discussion of Dr. Hawley's Paper.

Dr. Ralph Waldron, Newark, N. J.

Mr. President, Members and Guests of the American Society of Orthodontists: There is but very little I can say in opening the discussion on Dr. Hawley's paper except to indorse his appliance, and this I most heartily can do, for it has been a great aid to me, not only as a retainer, but as a working appliance in certain cases which I will explain later.

About three years ago while visiting Dr. Hawley in Washington, our conversation drifted to the problem of retention, and in his remarks Dr. Hawley said: "I have a copy of a paper written by Dr. R. D. McBride of Dresden, Germany, on a removable retainer, which possesses some admirable features; also some disadvantages; I will let you take it."

On one of my subsequent visits to Dr. Hawley, I found he had overcome some of the objectionable features, such as more secure attachment, closer adaptability, simplicity of adjustment, etc.

I went home most favorably impressed with the removable retainer, and began using it almost exclusively with various modifications to suit the cases at hand.

I do not wish to discuss the construction of this appliance, for Dr. Hawley has already done so, but will try to explain the dynamics of this appliance.

Fig. A shows the retainer with a loop in the labial alignment wire for the adjustment of the same and wire clasp which fits accurately on the first bicuspid tooth, making a very secure attachment.

If we close up the loop which is located in the cuspid region a millimeter or so, the labial alignment wire is shortened just that much, bringing the six anterior teeth into a more normal approximal contact, and also a more lingual position than they previously occupied.

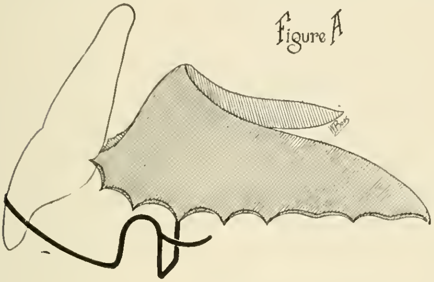


Figure A

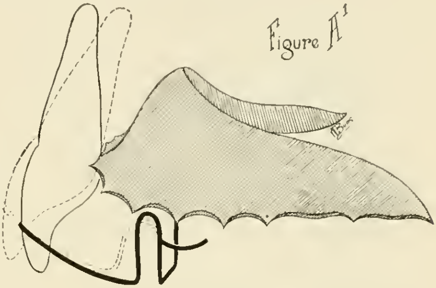


Figure A¹

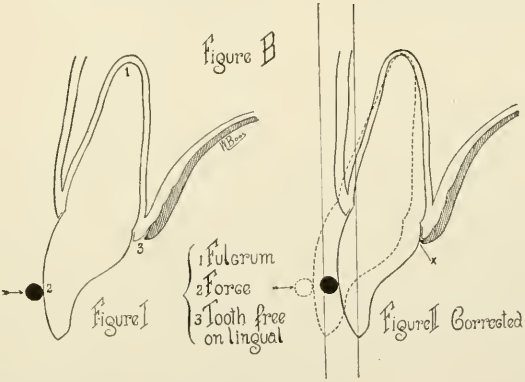


Figure B

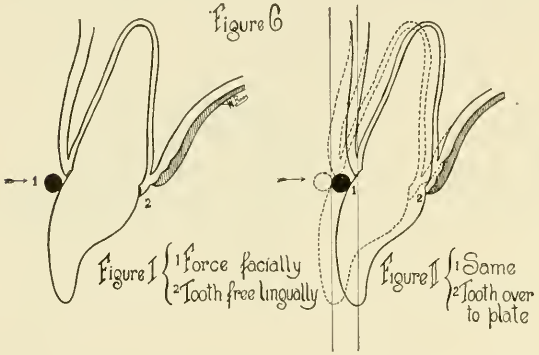
This is well shown in Figure A.

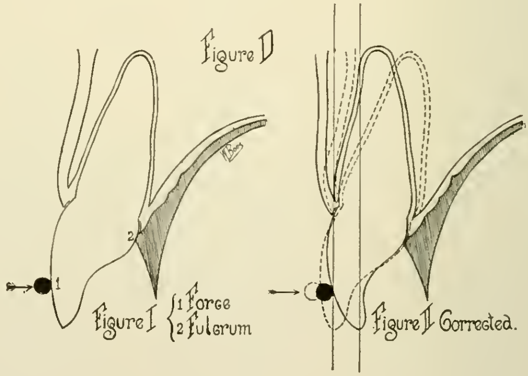
Fig. B shows a sectional view of an incisor tooth and a removable retainer. The shaded portion is a cross section of the vulcanite portion of the retainer, and the dark circle shows a cross section of the labial alignment wire.

If the force is applied in the direction of the arrow by closing the adjusting loop of the labial alignment wire, then the fulcrum will be at the apex of the tooth 1, and the tooth will be moved until it comes in contact with the vulcanite portion of the retainer at the point X as shown in Figure 2 corrected. Then if more force is applied at 2, the point X becomes a fulcrum, and we now change from a lever of the second kind to a lever of the first kind, which would result in moving the apex forward.

Fig. C shows the alignment arch close to the gingiva. If force is applied in the direction of the arrow, the tooth will be moved toward the lingual, more bodily than in the previous Figure B.

In the treatment of distocclusion cases, particularly when accompanied by labioversion of the upper incisors which are often considerably elongated (Class II, Division I Angle), this is an admirable post treatment appliance.

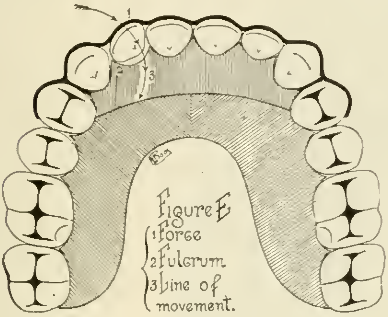


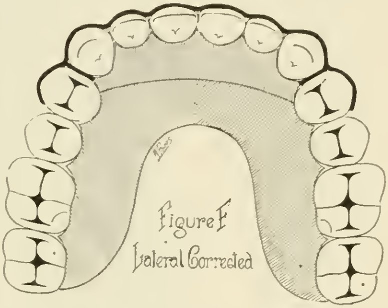


We cannot expect to equalize the arches with this appliance, but we can change the angle of inclination of the incisor teeth and keep the mandible forward without intermaxillary elastics by means of a bite plane attached to the appliance as shown in Fig. D, thus depressing the incisors both upper and lower and opening the bite in the posterior region, which will permit of the elongation of the bicuspid and molar teeth if the case should require it.

Fig. E shows an occlusal view of this retainer in position. You will observe the right upper lateral in torsoversion. If the labial alignment arch is bent so as to bear with slight pressure on the mesial approximal angle, the tooth will be moved as indicated by the arrow until it occupies its correct position as indicated in Fig. F.

While this appliance is new to us as a retainer and a great deal of credit is due to Dr. Hawley for its development, I find Dr. V. H. Jackson used a similar appliance as shown in Fig. 403, Jackson's *Orthodontia,* 1904 Edition, for jumping the bit forward, a term used in those days for bringing the mandible forward.





Dr. Jackson makes no mention of using this appliance as a retainer as will be seen from the following description of Jackson's appliance found on page 340 of his book, and you will note from the illustration and description that the clasps for attachment are dissimilar from those advocated by Dr. Hawley.

"*Jumping the Bite Forward.*—When the jaws are inharmonious in their mesio-distal relations and jumping the bite forward is indicated, any spaces that exist between the teeth of the upper arch should first be closed by moving them inward, and an apparatus anchored in each arch for the attachment of small rubber bands for causing the required anterior and posterior traction as described; or a semi-circular spring can be shaped to pass in front of the incisors with the ends anchored in a palatine vulcanite plate used to support an inclined plane, as seen in Figure 403. The plate is made with suitable means of anchorage, as with spring—or wire—clasps, with a projection of rubber extended from the anterior part sloping sharply downward and backward for forming the inclined plane; it should be shaped so that during occlusion it will pass back of the lower incisors and cuspids, causing the lower jaw to be moved forward for a distance usually equal to the width of one of the bicuspid teeth. The closing of the lower incisors against the inclined plane in the manner described has the effect of stretching the lower jaw, encouraging its anterior development." (See Fig. G.)

Dr. Hawley recommends that you wax up these retainers and send them to the laboratory to be vulcanized and finished.

Fig. 403.

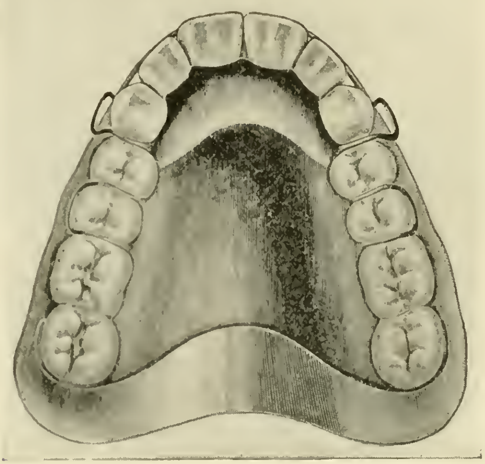


Fig. G.

This procedure I would condemn for they are very likely to file and polish away the very parts you need, and thereby ruin the retainer, particularly if you have a bite plane which is to perform other functions than keeping the mandible forward, which I have previously mentioned.

Dr. Alfred P. Rogers, Boston.

A few weeks ago it was my privilege to spend several hours with Dr. Hawley in his office, during which time I examined five or six patients who had reached that stage of treatment where the application of the removable retainer, which Dr. Hawley has been telling us about, seemed to be beneficial. One of its features that impressed me particularly was its value from the prophylactic standpoint. In many cases it would seem that the patient might be rid of bands and wires of various sorts at least a year in advance of the other modes of retention. The teeth being *free from unnecessary restraint* are enabled more readily to settle into final adjustment. I believe it is going to be particularly valuable in undertaking muscular work in an endeavor to establish functional activity which is so essential to the permanence of occlusion.

Of course, I imagine there are some types of irresponsible patients where it might prove disadvantageous to make use of this kind of appliance, but the failures on this account would be few. The appliance is used mostly on patients who have had considerable experience, being applied when the case is nearing completion.

Dr. Bert Abell, Toledo, Ohio. I am anxious that this appliance and Dr. Hawley should have all the credit that is due it and him, but there is one thing to its disadvantage, it seems to me, that has not been mentioned either by Dr. Hawley or Dr. Waldron. In a fixed retention like the Lourie arch, cemented of course, with both upper and lower fixed, it takes a very successful man to adjust his arch so that there will not be a spring in one jaw or the other in the teeth where the bands are cemented. The posterior teeth, the bicuspids and molars, with this appliance, are perfectly free to move in any direction that the occlusion seems to force them. They can settle together without any interference with the appliance. They can settle into normal occlusion as far as the adjustment of the appliance is concerned. That is one disadvantage I find in using the Lourie retention. Unless I am careful to use a horizontal tube on one of the jaws, either upper or lower, there is a spring of one set of molars or bicuspids. That is one disadvantage, it seems to me, because we all admit that every tooth should have all the freedom possible to move in a normal arch or circuit, or whatever you may call it, retained only so that it does not get out of position. The disadvantage of the Hawley plate occurs in the anterior teeth. There is not sufficient mobility, in my judgment, with the bar across the front, and what amounts to a bar, the vulcanite rubber at the back.

Dr. Ralph S. Baldwin, Washington, D. C. I would like to add a few words to what has already been said with regard to this retainer. I have worn these retainers for something over a year, and I have put them to every kind of use and abuse for experimental purposes, and personally I cannot say too much in favor of them. As the doctor said, I used the appliance for my case of protrusion; my upper teeth shut inside of the lower. After two years or more of treatment I established very fair occlusion and have maintained it with these retainers.

There is another good feature. I lost recently a right lateral, and I immediately took an impression and attached to the appliance another tooth and it worked nicely indeed. There are some cases in practice where the teeth are congenitally missing or fail to come in, or there may be reason for maintaining spaces, and instead of the wire clasp and leaving a space, this plate can be utilized to supply the missing tooth.

I have had the opportunity along with Dr. Hawley of applying two hundred of these retainers, and we can show you how simple this retaining appliance is.

Dr. Frank M. Casto, Cleveland, Ohio. I would like to ask Dr. Hawley whether or not the patient wears this retainer continuously.

Dr. Hawley. I answered that question, I think, in the paper. These retainers can be removed at any time. For two or three or six or seven months I have them worn day and night, according to the character of the case. About six months, which is not a definite time, or after a certain time they only need to be worn at night.

Dr. F. M. Casto. The point I want to bring out is this: Whether or not the continuous wearing of the plate will interfere with the functions of the soft tissues about the teeth, and whether or not this interference with the soft tissues may not change the secretions of the glands and make the teeth more liable to decay because of that fact. I wondered whether Dr. Hawley has noticed that particular thing or not.

Dr. Hawley. You must remember that this plate is not worn continuously, and the effect of vulcanite on the mouth is nothing so far as I have observed.

So far as the condition of the teeth and health of the patient are concerned, there is no one closely connected with me who has been so delighted with this retention as Dr. Gearhart of Washington. He is a periodontist, and a great many of my patients go to him for treatment. During retention these plates can be slipped off and the teeth can be properly cleansed. They have noticed absolutely no effect upon the soft tissues from wearing the plate. As I have said, they are not wearing these plates continually. The night wearing of the plate does not affect the mouth.

Dr. George B. Winter, St. Louis. If a child had the lateral incisors missing, I would like to ask Dr. Hawley how long the child could wear a plate of this nature?

Dr. Hawley. I do not know. We supply these teeth during the retention period, and there comes a time when the missing teeth must be replaced. You can stop this retention when you please. If you reach the stage when you should want to supply a missing tooth permanently, a new plate must be made or the entire retention abandoned. That can be decided by conditions.

Dr. Ralph S. Baldwin, Washington, D. C.

In cases where the teeth are slightly rotated, with a tendency to be lingual to their normal occlusion, before the plate is waxed up, the lingual surfaces of the teeth can be slightly cut away, and there will be an excess of vulcanite that will be in contact with the trimmed tooth, but after wearit for a few a day or so, the tooth will be forced to normal position, and if you recognize that when you wax the plate up it will be more satisfactory than building up contacts with cement.

I have had several cases in which, when we took the apparatus off, the perspective looked almost perfect, but when it came to a more careful and minute examination you could determine to a fraction here and there that certain teeth should be slightly rotated. In bending the wire on the labial surfaces of the tooth, if the tooth is rotated, it naturally causes an irregularity in the outside contour line, and that is sometimes shaved off and the wire is passed squarely over it. When the plate goes into the mouth it will contact strongly at that point where the plaster was cut down. By thus cutting and fitting and securing the plate accurately and forcibly with a clamp, a great deal of the final and accurate finish of the work can be accomplished.

Dr. V. E. Barnes, Cleveland, Ohio.

Dr. Hawley made the statement that this appliance was not original with him, that it was Dr. Jackson's idea. I used this appliance or a similar one for six or seven years, but have not employed it for the last four or five years because I found too much decay occurring. The temptation is too great to let the patient go for too long intervals between visits.

Dr. Casto raised the point as to whether the continual wearing of vulcanite over gum tissue may not in some way injure the soft tissue or deteriorate the tooth structure. I am inclined to think it does, but whether it is from irritation or change of function, or overheating or something of that sort, I do not know, but I do know that a tremendous amount of decay has occurred in some cases and the observation was not *post hoc.*

I have given up the use of the plate until I could get enough help to make a metal plate.

Dr. Waldron.

The great problem with all these appliances is whether you can trust your patients to wear them. After you have worked on a case for two or five years, you want to be pretty sure you can trust a patient with a removable apparatus of this kind. You are putting your experience and your work into that patient's hands. If he can be trusted, all right. If he cannot, do not use that kind of appliance. We find very often that we can get adjustment in a local area which we could not get by these little labial wires. By cementing or soldering on little pins and little cross pins, you can put tension on a tooth which will check rotation, or rotate it if you want that done. These little pins need not be made of heavy metal. They must not be very long, not over one-eighth of an inch. Even that is too long for certain cases. There must be some slight range of adjustment which must have slight tension, but they give you an adaptability greater than horizontal wire.

Dr. Hawley. Dr. Waldron has used these retainers on deciduous teeth. I have not tried it, because my whole energy has been fixed on the question of retaining a complete denture.

Dr. Abell asked about the mobility of the anterior teeth. My impression is that the anterior teeth are less restricted and more mobile.

So far as the correction of the overbite is concerned, I do not know that I could describe just exactly what takes place in such cases. My idea is that the bicuspids and molars move down bodily to complete occlusion and the alveolous and soft tissues of the mouth with them, but later there is reciprocal adjustment of both the anterior and posterior teeth.

The small pins Dr. Waldron spoke of, soldered to the bar, in my experience are unnecessary. I am giving you my experience; I am not at all arbitrary about it, but I have not found these pins necessary.

Dr. Barnes says he has had trouble with rubber plates irritating the soft tissues. You may have that trouble with a rough porous plate. I emphasized in the paper the desirability of vulcanizing the plates on a heavy tinfoil, which produces a hard, smooth surface which is not irritating.

The most important objection to a removable retainer is the question of the patient's losing it. I have put in something over two hundred. I have had three patients who lost their plates. In one case a girl called me up saying that she was going away to a boarding school. She called me an hour before her train was to start, stating that she had lost her plate. She went off and came back four months later, saying she had found it about three weeks afterward; the teeth were all right. Another patient, a young man in the Army, lost his plate last June, and I have not seen him since. Another boy going to school sixty miles from Washington lost his plate, came into the office the next Saturday. I took an impression, and the following Saturday put in the plate, and all went well.

I would rather make each patient five of these plates to guard against loss than to leave them with fixed retention.

My experience has been that there is less irritation of the soft tissues, less injury to the teeth with these removable retainers, than there is with fixed retention. The patients will occasionally lose a plate; there is no denying that, and there will be some cases where the soft tissues are injured by any retainer, but all retention has objections. If we could make our corrections and take off our appliance and dismiss the patient, and the teeth would only stay exactly where we place them, that would be ideal, but we know they will not, and there is no retention which has not certain objections.

There is one feature of this retention that I do not know whether you fully grasp or not, and I bring that out by asking you this question: Is there a man here who can tell me how long any case needs retention? Can any of you with the longest experience tell within three months how long a case will need retention? I do not believe there is one of you who can do it. What do we do? We put in a retainer and guess at it. We get the patient to wear it as long as we can, and in two or three years we take it off. Do these teeth stay? They do not in most cases. It may not be serious enough to take up the case again and re-treat it. But suppose you do take it, as I have done, and treat it again. Do you know any more the second time than you did the first?

The most important question is: Can you retain a tooth from rotation with a removable retainer? I know you can, and you have something there that relieves the patient also from the appearance of a fixed retainer. They can keep them for years. You can abandon one whenever you please. You can take the retainer for a certain time, but you have a check against adverse movement for many years.

Here is another advantage. Some patients, many of them, want to appear, at least for a few hours, without anything on their teeth, and the removable retainer is a source of great relief to them. I have had a number of patients say to me: "If you can regulate my teeth and can retain them so that I can once in a while appear without any bands on the teeth, I am willing to have it done."

Dr. F. M. Casto. I was a little suspicious that these plates might have a deleterious effect on the soft tissues, and those suspicions have been confirmed, because I have noticed in the examination of this model that there has been a great change in the tissue. I do not know how long this appliance has been worn. I would like to have Dr. Hawley explain the changes that have taken place.

Dr. Hawley. It is one of Dr. Waldron's models, not mine, so I need not explain it. (Laughter.)

Teaching Our Patients to Overcome Undesirable Muscular Habits.

By Alfred Paul Rogers, D. D. S., Boston, Mass.

There are many roads to failure in the practice of orthodontia. Insufficient knowledge and lack of judgment in reference to the mechanical requirements of a given case may be considered one of the most frequent sources of failure. On the other hand, a skillful adaptation and manipulation of appliances may promise to terminate in an ideal result so long as fixtures are operative. Unfortunately there are factors which rob the orthodontist of certainty of success at this stage of treatment. If the facial muscular balance of the individual is in the least disturbed, maladjustments corresponding in degree to the improper functioning of the muscles almost inevitably make their appearance. Last year it was my pleasure to read before the Society a paper setting forth the principles of muscle culture under conscious guidance of the patient. The aim of that paper was to emphasize the importance of training the various facial muscles to a full performance of their functions. It has been my experience that more satisfactory results are obtained by giving proper attention to that phase of the treatment.

It is my purpose in this short paper to bring before you a few suggestions that I trust may be of value when undertaking the control of muscles which may or may not be deficient in strength or tonicity, but which are nevertheless the sources of orthodontic defects, and which may, if uncorrected, exert their evil influence after the skillful work of adjustment has been accomplished. The muscles which I refer to are those which are by some token influenced in their action by stimuli received from an unbalanced nervous system. The malinfluence of muscles habitually under improper control is of such a serious nature, and is so common and yet so far from being mastered by us, that I trust what I say may be understood as merely making an attempt to awaken the minds of all the members of this Society to the ultimate good that may be accomplished if we all pay more heed to the problems of this nature.

It is the task of the orthodontist to familiarize himself with all influences that have a bearing on his work, and his final results are a test of his diligence in acquiring this knowledge and effecting its practical application. It is not necessary at this time to attempt to enumerate all the faulty actions that the muscles in and around the face are capable of assuming. It will be sufficient for each of us to call to mind some one or more of his own patients who have balked his efforts by their seeming inability to control certain muscular actions. While thus engaged it should occur to us that if we are able to teach our patients conscious control of any unruly muscle or group of muscles it will be greatly to their advantage as well as our own.

The Psychological Aspect of Muscle Training.

Vicious habits which endanger the permanence of our results are assuredly on the increase. Every orthodontist of experience has among his patients almost every type of child, but the most trying are those who have assumed habits which combat his skill. In helping our patients to help themselves we have a psychological problem. It is none other than the teaching of our patients to break old and disastrous muscular habits and substitute in their places normal muscular action. In teaching conscious control of any muscle or group of muscles it will be understood that the will of the child must be so strengthened that it is able to withstand the insidious demand for wrong actions. The seat of the trouble is in the mind, and to the mind the operator must direct his attention. It will frequently be found extremely difficult to assign any reason for many of the actions which will come under his notice. In fact, the majority of these habits are exasperatingly unreasonable and therein lies a potent cause for anxiety. The actions are almost invariably found to be unconsciously performed. Some actions are slow, others are so quick as to almost deceive the eye. Some are performed during the waking hours, some during the hours of sleep. Studious children, of a not too robust constitution, are frequently found to be victims of these self-deforming habits. In a word, they seem to be an accompanying compensating evil which nature exacts of us more and more as civilization advances. It is, therefore, imperative that we should recognize our duty in this matter if we may hope ultimately to rid our patients of their faulty muscular actions.

In undertaking the treatment of these victims of habits one of the first duties of the orthodontist is to endeavor to establish a more healthy and more normal environment for his patients. Prescribe more out door life, more natural modes of living, greater care in selection of foods, less anxiety on the part of the parents for the extra scholastic standing by these children which is so often obtained at the cost of serious sacrifice of health through the excessive demand on their nervous energy. It means that the orthodontist must become instructor to the parent, and in undertaking this task he must be well prepared with good and sufficient arguments to break through that irritating and unreasonable wall of scholastic ambition.

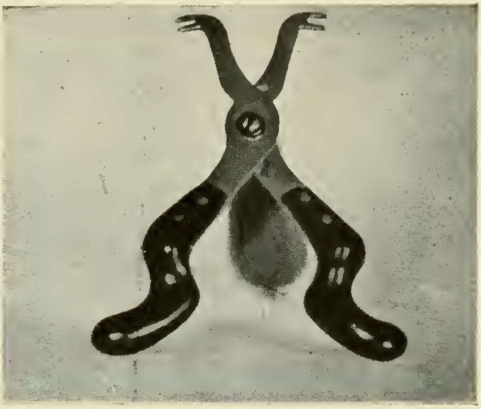


Fig. 1

Co-operation of Parents.

Without some sort of co-operation by the parent orthodontic work requiring the correction of habit is discouraging—our efforts for the child in most cases will be of little avail. You are all familiar with the mother who upon her initial visit will tell you, in the child's hearing, that the patient is nervous and hard to manage, etc.—little realizing that this method of parental suggestion is not only a strong factor in undermining the child's health, but is a positive agency in producing poor orthodontic results. Such parents should be instructed regarding the power of suggestion and given a few concrete examples showing what may be expected if such suggestions are continued.

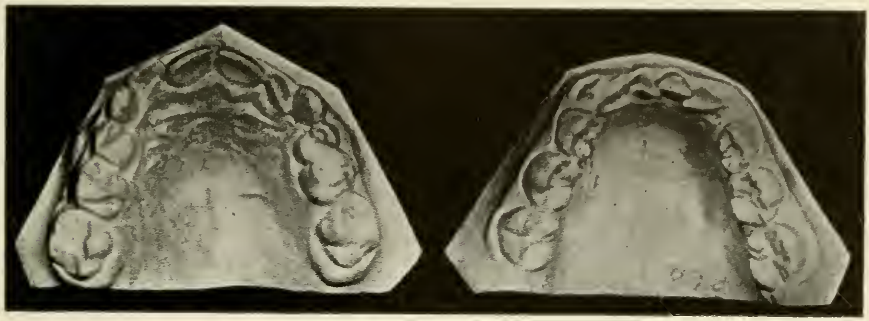


Fig. 2

The Influence of Suggestion.

One of the most important phases of this subject that the orthodontist must remember when dealing with parents, is to remind them that negative suggestion is wrong suggestion. Show them how frequently it happens that the child brought up under negation is either docile and uninteresting or indifferent to right suggestion, or becomes positively rebellious by reason of the constant irritation consequent upon this kind of treatment. It is usually good practice when undertaking the correction of any habit to request the parents to make no reference to the habit in the hearing of the child; to leave the entire treatment in the hands of the operator. It is then essential that the child's attention should be called to its abnormal performance in such a manner that it is brought to understand the nature of the habit and its consequences. Next, *there must be created within the mind of the child the conscious desire to rid itself of whatever action is proving disastrous.*

Continuity of Treatment Necessary.

These are the first and fundamental steps, and they are not always easy of accomplishment, but after a few successful attempts the orthodontist becomes more skilled and is able to apply these principles to a greater and greater number of those who are in need. The efforts cannot be intermittent, but must constitute as regular and as active a part of the treatment as the application and adjustment of appliances. They must also be accompanied by whatever methods the operator finds necessary for the building up of the health and strength of all muscular tissue surrounding the muscles

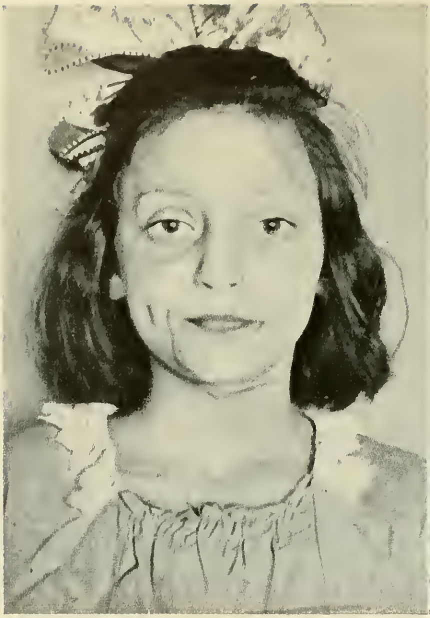


Fig. 3

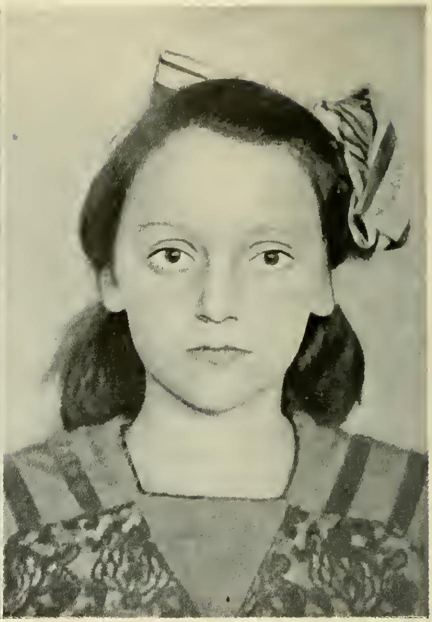


Fig. 4

involved, because teaching the conscious control of other groups of muscles will tend to develop a stronger will power in relation to muscle work—one that will be instrumental in destroying the abnormal impulse.

On some occasions it will be found of value to drill the child on conscious control of one muscle at a time. If any group of muscles is found to be lacking in tonicity, exercises of any nature which will tend to produce a more healthy group may be employed. For instance, in the correction of the habit of mouth breathing, after adenoids and nasal obstructions have been removed, it is well to institute a general facial exercise such as the one referred to at our last meeting.

Exercise for Orbicularis Oris Muscle.

Accompanying this exercise a special exercise for the orbicularis oris is often found of value. For this purpose I have constructed a small exerciser which the patient uses at home, and which is shown in Fig. 1. The hard rubber parts are inserted between the lips which the patient is directed to contract stretching

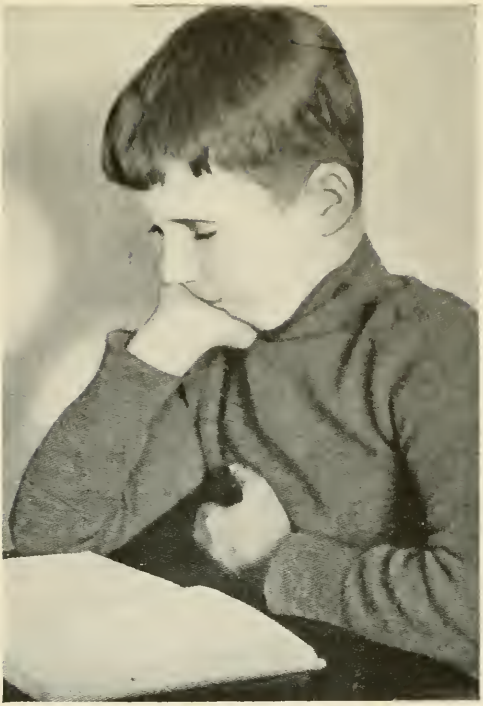


Fig. 5

as far as possible the elastics which engage the opposite levers. Elastics may be added as the strength of the muscle increases. I have in mind a young boy who habitually held his lips apart. The lack of balance thus produced allowed a protrusion of the upper incisors to take place. After a few months of effort in the strengthening of the orbicularis oris marked improvement was seen in the position of the upper four anterior teeth, and the use of appliances became unnecessary. Other instances might be mentioned where marked improvement in mandibular positions has been obtained by conscious effort of the patient himself. The improvement has been so gratifying that it prompts the belief that the more attention we give to details of this nature the more permanent and satisfactory will be our results.

Faulty Deglutition.

Fig. 2 represents a class of malocclusion due largely to faulty muscular action. It was discovered that this child had acquired by imitation a faulty act of deglutition. Fig. 3 represents the child in the act of swallowing. This photograph was taken very carefully, and is accurate in every way. An excess of muscular pressure was brought to bear upon the teeth many times a day. A digital examination of the face during this moment of contraction showed an extremely vigorous tension of the muscles involved. In fact, the pressure was so great as to overcome the influence of the lingual wire for a short time after treatment was in progress. This patient was carefully informed of the existence of the habit. The futility of further treatment was explained to her in such a manner that she was able to comprehend the seriousness of the situation. A conscious desire to rid herself of the unfortunate habit was instilled in her mind—then careful instruction and practice in the proper use of the muscles involved in the act of deglutition. Fig. 4 illustrates this same child again in the act of swallowing, but after she had practiced and learned conscious control of these muscle groups. Treatment was then continued with a fairer prospect for satisfactory completion.

Many like instances might be given all varying in detail, but in underlying principles the same. I, therefore, shall not weary you by repetition, as each of you can call to mind experiences in your own practice, but I will present just one more case which has in it a suggestion of why we sometimes fail in teaching the proper control of the pterygoid muscles. This boy (Fig. 5) had been under my care for some time and showed very satisfactory improvement in following various exercises such as were presented to you at the last meeting, but disappointment at the slowness of progress led me to inquire into the habits of the child. I wished to place him under observation, and in order to do so I allowed him to remain in the room while treatment was given his little sister. Being a studious lad he was under best observation while mentally absorbed. Therefore, my assistant secured for him a book, placing him at the table. It was not long before the cause of my disappointment was discovered. Fig. 5 shows the habitual attitude of this young boy. When the father returned for the children he explained that this position was habitual at home, being the manner in which the boy usually studied or read. Many hours each day were spent in this attitude.

It will be profitable for us to grasp the idea that in our work with these little people it is not alone essential that we labor for the establishment of occlusion through mechanical means, but that we shall, with intelligence and patience, teach those under our care how they may also aid in the correction of their own difficulties by conscious well directed actions which will result not alone in the correction of their deformities, but will fortify us against the inconvenience of the recurrence of treatment, giving us greater assurance of the permanence of the results.

Preventive Orthodontia.

By Raymond J. Wenker, D.D.S., M.D.
Professor of Orthodontia, Marquette University, Milwaukee, Wisconsin

In presenting this paper the author wishes to direct your attention to a large unorganized field of practice. Some phases of it have been practiced by the orthodontist for a great many years, while some he has overlooked or allowed to pass into the hands of the pediatrist, the eye, ear, nose and throat specialist, the general surgeon, the general dentist, etc.

Definition.

Preventive orthodontia comprises that field of practice which has for its object the foreseeing and preventing or inhibiting, as far as practical, of all etiologic factors of dento-facial malrelations.

Preventive measures, when compared with corrective measures under like conditions, are of a greater benefit to mankind. The prevention of an affection insures a greater physiologic result than it is possible to attain by corrective means. The most successful preventive measures prevent the establishment of pathologic processes, foreseeing and interdicting all handicaps to the normal physiologic growth.

Prevention in every-day practice is only occasionally so perfect as to anticipate and prevent all conditions, but more commonly it consists in recognizing and removing existing handicaps. The removal of these handicaps virtually amounts to making many minor corrections to prevent the later necessity of greater corrections. The necessity for these corrections should decrease as preventive treatment becomes more universally and effectively practiced.

The orthodontist has in a large measure neglected the most important part of preventive orthodontia, namely, the early stages of growth, when most of the etiologic factors begin.

Educational Propaganda.

It is indeed difficult to decide how early this field of practice may begin. Perhaps a good point to begin with would be with the prospective mother, in the form of an educational propaganda. I do not wish to discuss in detail what this propaganda should consist of, but in general it should include a consideration of the physical, mental and moral requirements for the mother to acquire and maintain her health and the health of her child. Every mother should be informed how to live to bring a healthy child into the world. She should know that no greater honor and privilege can be bestowed on her than that of giving birth to a healthy child. And to this end she should be taught sane, hygienic and rational methods of living, that she may substitute them for her superstitious and fallacious ideas.

This phase of the subject overlaps that of the pediatrist's, but I can see no good reason why this propaganda should not be a combined movement including all parties interested and qualified to join in the undertaking.

Etiologic Factors.

One of the earliest active factors which influences growth is that of infection of the mother occurring prior to or during pregnancy. The most important of these is probably syphilis.

Syphilis.

If a fœtus becomes infected with syphilis it may die and be aborted. If perchance the syphilitic mother should develop a degree of immunity against the *treponema pallidum* the next pregnancy may result in the birth of a living child. Or if, by reason of anti-syphilitic treatment of the mother, the infection is reduced, the future pregnancies offer more encouragement. The recognition and treatment of this infection is indicated. The physician in charge will be the one called upon, and his duty it will be to diagnose and treat not only the child, but the father and mother as well. The infection, however, may be so mild as to be overlooked.

Evidences of syphilis may frequently be recognized by the orthodontist in early childhood. The manifestations common in the new born are coryza, mucus patches, and skin eruptions. When these heal they leave scars, especially at the angles of the mouth and nose. Other manifestations later in life may be: affected sight, hearing, gummata in various parts of the mouth, Hutchison teeth, etc. Tardy eruption and extensive cavies are also conspicuous in this affection.

Congenital Defects.

Congenital defects, namely, hare-lip and cleft-palate, are important affections interfering with normal jaw development and should receive early treatment. These children are frequently weak and delicate, and require the care of the skilled oral surgeon. Treatment of these cases may be regarded as preventive measures in the field of orthodontia.

Acute Infectious Diseases.

The acute infectious diseases of childhood are important causative factors in the development of dento-facial malrelations. These affections are of interest to the orthodontist from the point of view that they favor or produce hyperplasia of the lymphoid tissue of the naso-pharynx and also cause a general prevention of metabolism, and thus influence the growth of the child. Every general metabolic disturbance has a corresponding influence in jaw development, especially during the early stages of growth. The usual treatment is indicated in these affections.

Glands of Internal Secretion.

Federspiel has suggested that pituitary disturbances may have a bearing on jaw development to a greater extent than we have heretofore recognized.

There are two types of pituitary disturbances which may occur in childhood. The one is hyper-pituitarism, which produces excessive growth, and the other is hypo-pituitarism, which has the opposite effect resembling cretinism. In disturbances of the thyroid gland there is but one type which is of interest to the orthodontist, and that is hypothyroidism, known as cretinism.

All bone dystrophies due to disturbances of the endocrine glands should receive organotherapy and other rational treatment according to indications.

Nutrition.

It has been evident for many years that the nutrition of the child in the first months of life is of great importance in relation to future growth. It appears that a given handicap to normal metabolism is more harmful in proportion as it occurs earlier in life.

Dietary Considerations.

Dietary considerations are therefore the next in order, and although the physician in charge usually attends to this requirement, still the orthodontist should be familiar with this subject, that he may intelligently discuss it with the parents or physician in its relation to jaw development.

Williams, an authority on obstetrics, has submitted evidence of the infrequency of normal nursing of infants. He makes the statement that less than 25 per cent. of the mothers of New York State are able to nurse their children, and that that number is decreasing. Hellman contends that arrested development of the jaws is more prevalent among artificially fed infants than among the breast fed. He has estimated that 81 per cent. of arrested jaw development may be found in the artificial class. In the author's study of 643 children he has found 508 cases of mal development of the jaw in the artificial class, or a trifle over 79 per cent. That there is a large percentage of arrested development among this class is very evident to the observing orthodontist. This may be accounted for in the different proportion of the ingredients and digestible quality of cow's milk and other substitutes as compared with human milk.

Another interesting and valuable point in connection with artificial feeding is the greater susceptibility to infection among these children than those of the breast-fed class. This may be accounted for in the prevalence of defective metabolism as well as the absence of the immunity imparted by human milk. The adenoid type is therefore more prevalent also in this class.

There are two preventive measures which suggest themselves to the author which should be resorted to by the mother not able, or apparently unable, to nurse her children. The first choice is to encourage her organism to secrete milk by means of diet, exercise and massage —and the other is the old practice of employing a good wet-nurse. Both of these methods have proven very successful.

If, however, artificial feeding must be resorted to, there are two important points to determine. First, the digestive capacity; and second, the caloric requirement of the infant. The former should not be overtaxed in the effort to bring the quality and quantity of the food up to the caloric requirement. To this end the entire dependence on any single or any combination of proprietary foods is contra-indicated because of the large carbohydrate content and the deficiency of fat and protein which they usually contain.

Rachitis.

In the author's estimation, rachitis is one of the most important dietary disturbances in the entire list. I believe it is a much more active causative factor than it is generally conceded to be. Heretofore we have only recognized it in its most pronounced form. As a matter of fact, there are a great variety of minor manifestations, and particularly that of arrested jaw development, which have in a large measure been overlooked. Lischer has called our attention to mal-development of the mandible resulting from rickets. Holt and Fischer have also mentioned it as a factor, but in a rather general way. In the author's studies and clinical observation it appears that in every case of rachitis, with all of the gross classical symptoms there is usually a marked jaw deformity, equally as pronounced as the case illustrated by Lischer. There is also a large percentage of cases with minor general bone involvement which manifest comparatively mild forms of jaw deformities. Dewey has called our attention to the early shedding of deciduous teeth and tardy eruption of the permanent teeth in rachitic children. The absence of mechanical stimulus to the jaws supplied by erupted deciduous teeth from the time of shedding until the eruption of the permanent teeth must have a detrimental effect on their growth. Noyes has discussed this mechanical stimulus imparted to the growing jaws by the presence of the teeth. There is also manifested in rickets a tardy eruption of the *deciduous* teeth, which frequently causes much difficulty, such as inflammation, pain and suppuration. The artificially fed class, however, does not supply all of the cases of rickets. Among the Italian and Ethiopian races a large number has been observed in the breast-fed class by Hess. In his experiments with these cases he has used cod liver oil with success as a corrective and preventive measure. For further information on this subject I would refer you to these authors.

Parents should be made to realize the full value of the services of the orthodontists from birth to early adult life to aid in the prevention of jaw deformities. His counsel in conjunction with the physician in charge should be of real value, provided, of course, that the orthodontist equips himself with the necessary knowledge to make his services valuable. He should be well informed on all questions pertaining to infant metabolism. He should be especially prepared to explain all phases of jaw development and tooth eruption and to take care of delayed and abnormal eruption. All dietary errors and pernicious habits should be detected early and steps taken for their correction. The child should be encouraged to use its teeth as soon as they erupt. To this end, it should be encouraged to chew crusts of bread and other hard material, not for the food value, but for the exercise it may get in the effort. I believe strongly in the value of mouth gymnastics, beginning as early as possible and continuing during the entire growing period.

Much credit is due to Rogers for his valuable discussion of muscular exercise in corrective orthodontia. It is likewise very valuable in preventive orthodontia. The stimulating influence to the circulation and digestion, and therefore no normal metabolism, imparted by this method is very helpful. If, however, the supply of food material is deficient as to quality, no amount of exercise will serve as a substitute for good food. Converting them into play has proven quite successful, especially in the hands of a clever mother. Another method is to reward the child for carrying out the exercises. As the child progresses in development it is, of course, understood that its teeth should receive regular prophylactic treatment. They should be kept filled and hygienic. In fact, the entire mouth as well as the nose and throat should be kept in good health during the growing period.

Adenoids and Tonsils.

A very important branch of preventive orthodontia, namely, the diagnosis and treatment of adenoids and troublesome tonsils, has been largely neglected by the orthodontist. If preventive measures are to be practiced in part, may I ask the question: why should not all preventive treatment be included? If the orthodontist is not prepared to do so, has he made ample preparation to practice his specialty? I contend that he should be prepared to practice all reasonable and legitimate phases of it.

Bogue, of New York, has called our attention to the frequency of arrested development of the jaws in early childhood. He maintains that the deciduous teeth should show a definite spacing between the ages of two and six. In other words, nature should anticipate and get ready for the eruption and alignment of the larger set of teeth which she is growing in the deeper structures. This spacing should become manifest as early as two or three years of age by the expansive growth of the jaws larger than is necessary to accommodate the deciduous teeth. When it is most pronounced it may be observed in all parts of the arch. The widest spacing usually appears in the anterior part of the arch. In less marked cases it is evident between the anterior teeth only. Unfortunately, however, this spacing is absent, or is evident only in slight degree, in an extremely large percentage of the children of the present period. Bogue states that from 94 to 95 per cent. of the children of the present period present evidences of arrested development of the jaws from two to six years of age. He has also called our attention to a normal minimum size of deciduous jaws. They should not measure less than 28 millimeters in width between the lingual surfaces of the molars on one side to the same location across the arch. All jaws above this width manifest a definite spacing, and all below show an absence of or deficient spacing. While we are disinclined to accept a definite measurement as indicative of the normal or abnormal, still a minimum measurement may serve the practical purpose of indicating, in the average case, the dividing line between the two classes.

The large percentage of arrested development of the deciduous jaws which Bogue has estimated, I presume, is calculated on this minimum basis. This percentage appears excessive; nevertheless we all agree that there is a marked prevalence of arrested development in the present period.

Arrested development of the jaws is also to be observed in the adult. Abundant evidence of it is constantly before the mouth, nose and throat specialist. In an examination of the mouth, nose and throat of 2,800 recruits for the U. S. Army, the author has observed arrested development or deficient width of the jaws in fully 90 per cent. The cause of this condition was not ascertained, but the great prevalence of it was carefully noted during this examination.

What relation there may be between the large percentage of bottle-fed children, the large number of rachitic cases, and the large percentage of arrested jaw development is impossible to correctly state. The 75 percentage of Williams, the 81 percentage of Hellman, the 78 and 90 percentage of the author, and the 94 percentage of Bogue are at least suggestive of a relationship.

These figures are, however, subject to modification by making a study of a still larger number of cases and by making due allowance for numerous other conditions. Racial, climatic, social and economic conditions have their influence, and these have not received due consideration in a study sufficiently elaborate to make them final. We may, therefore, accept them as bearing only a tentative relationship.

Treatment.

The treatment of these cases should consist of both *preventive* and *corrective* treatment. The question is: "To what extent can these arrested and maldevelopments be prevented?" It is probable that much can be done by an educational propaganda among mothers, as previously mentioned. This propaganda should in the course of years effect a large reduction in the number of these deformities.

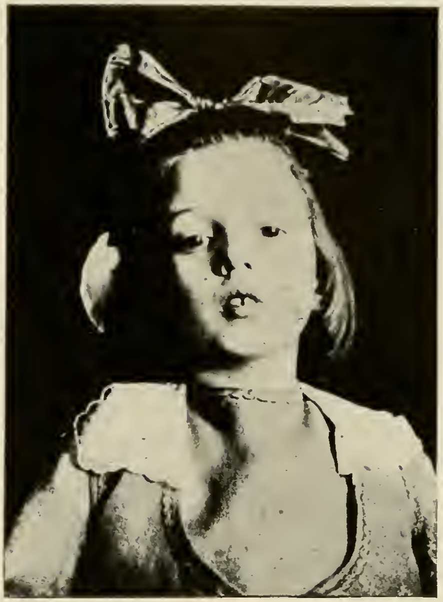


Fig. 1

Corrective Treatment.

As soon as this arrested development can be diagnosed, namely, between the ages of two and six, if the health and stamina of the child will permit, expansion of the jaws may be undertaken. Unfortunately, a very large percentage of these children are unmanageable because of an unstable nervous system and harmful teaching. Much depends on the stamina of the child, and still more upon the skill of the orthodontist. If, however, a given child cannot be managed, the only alternative is to postpone the treatment.

Method.

The question of method may be briefly considered at this point. The Richardson plate, or some modification of it, seems the most feasible. The modification which appears practical to the author for this purpose is a removable basket, lingual arch, or the new Jackson appliance secured by means of bands cemented to the teeth, provided with lugs or tubes by means of which to automatically lock the appliance in place. This may be made so secure that the child cannot remove it, but the operator can.

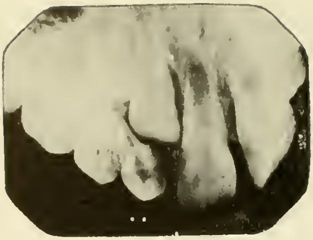


Fig. 2

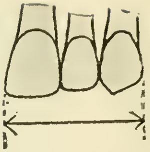


Fig. 3

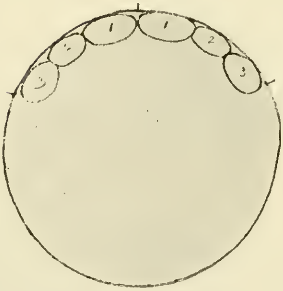


Fig. 4

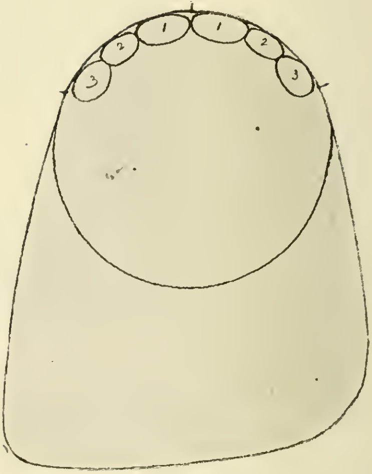


Fig. 5

Predetermination of Permanent Arch.

The next step is the predetermination of the permanent arch in order to serve as a guide in the expansion of the deciduous arch. This method, however, which I am about to describe, is not intended as a scientific correlation, but rather as a suggestion based on esthetic correlation. If expansion is undertaken before the eruption of the permanent anterior teeth, a radiograph of the upper central, lateral and cuspid on the side may be taken to determine their total width. (Figs. 1 and 2.) Using this measurement as the radius (Fig. 3), draw a circle with a pair of calipers to represent the curvature of the upper permament arch from the distal surface of one cuspid to the distal of the other (Fig. 4). Then enlarge the X-ray of the labial aspect of the central crown by photographic means until the labio-gingival curvature corresponds in size to the arc of the circle. This enlarged photograph of the central is then cut out on a line corresponding with the gingival curvature and approximal sides. Place this cut photograph over the circle and its approximal sides furnishes a continuation of the arch from the distal surface of each cuspid distally (Fig 5). This completed arch line will serve as an approximate guide for the size and shape of the future permanent arch of a given individual.

Retention. The length of time necessary to retain a deciduous arch after expanding will vary according to whether the patient is giving active co-operation in muscular exercises, according to age, the type of case, and according to whether the arches have been over-expanded to allow for a certain amount of reaction of the tissues in contracting after removal of the appliance.

Conclusion. An educational propaganda on preventive orthodontia, including preventive pediatrics, should be organized on a large scale and should be composed of interested and qualified members among the laity as well as the professions. This organization should become a part of the general social service movement for better babies.

No field of educational activity can be a greater benefit to humanity than this.

A child with a defective initial growth is handicapped throughout life.

That the enormous prevalence of mal-development may be materially reduced there can be no question.

That this prevalence is largely due to artificial feeding appears evident.

The hazard to jaw development by artificial feeding is not generally recognized, neither by the laity nor the medical profession. Artificial feeding should be freely and persistently discouraged and the danger of it impressed on mothers.

The orthodontist should become a valuable consultant and co-worker with the physician in pediatrics. This should begin with early infancy in preference to the custom of waiting until a deformity is recognized.

A Preliminary Study of the Effect of Rickets on the Jaws.

By H. K. Hatfield, M.D., Boston, Mass.

In presenting this report on "The Effect of Rickets on the Jaws" no attempt has been made to include an exhaustive bibliographic review of the subject, but simply to give *first* an outline of some of the characteristic features and deformities seen on other parts of the body, together with some recent observations and conclusions of men studying the radiographic evidences of the disease; *second* to recall to your mind some of the recorded observations and assertions made regarding its deforming action on the *jaws* and as an etiological factor in malocclusion; *third* to show models of the teeth and jaws of the group of rachitic children under observation.

Rickets was recognized and accurately described more than 200 years ago, yet today its etiology is obscure and its relation to diet is not clear.

Symptoms of Rickets.

McCollum (1) says, "It is a disease of the first two years of life, and is especially prevalent in children in whose diet milk is replaced too largely by cereals and other vegetable foods not suited to the delicate digestive tract of the young child." The nutritional disturbances often leave the child delicate and emaciated and the muscles soft and flabby. One of the earliest diagnostic signs to appear is the "rosary", the row of nodules which form at the junction of the ribs with their cartilages, and though not always seen can usually be felt when present.

A common deformity is the flattening of the sides of the chest with a prominence of the sternum, "pigeon breast", so called. When these are sharply defined and the abdomen is distended, a marked depression appears called "Harrison's groove", running from one side to the other at about the level of the diaphragm. The head appears sometimes larger than normal and the prominent frontal eminences when they develop give the head a characteristic square-shaped appearance and can be readily distinguished from a hydrocephalic head which is symmetrically rounded.

The deformities seen in the arms and legs are sometimes extreme. The same epiphyseal disturbance responsible for the "rosary", enlarges the ends of the bones in the ankles and wrists. The legs may show all degrees of bow-legs, or knock-knee, and are sometimes bent in other directions. The arms also may be twisted and bent. A general rounded curve involving the whole spine may develop, or there may be a general collapse of the column.

Radiographic Study of Rickets.

It can be readily seen from this description that the most important and characteristic changes show in the bones, which are generally softened throughout the body during certain stages of the disease. Probably owing to some chemical change an imperfect deposit of lime takes place. The new bone formed as the child gets better seems harder than normal, the so-called "eburnated bone." Although comparatively little is known of the pathology of the disease the radiographic investigations of the bone changes are very interesting, especially in the matter of differential diagnosis.

Lovett's (2) contribution published in the *Journal of the American Medical Association,* December 11th, 1915, is highly instructive and appears to have been the first attempt to trace the stages of rickets through a definite radiographic sequence. His comparative study of 500 or 600 plates of rickets showed the disease to divide itself naturally into three stages. The knee-joint offered the most favorable conditions for study, but the same manifestations are found in the other joints of the body.

In the first, or acute stage, the joint appeared cloudy, the epiphysis casting little or no shadow and the diaphyseal ends frayed out instead of clear cut. A severer type showed a general bone atrophy in the diaphysis and pronounced periosteal thickening.

In the second stage the epiphyseal shadow becomes more marked, the end of the bone broadens out into a lip or ledge, especially on the side on which the strain is greatest. Cortical thickening on the concave side of the curved or bowed shaft is in the nature of a compensatory change in the bone structure.

The third stage carries through the period of convalescence. Epiphyses are clearly outlined and ossified and there is increased density of the bone.

The thickening of the periosteum in the earlier stages cleans up and shows no tendency to bone formation.

This is about all the pathology known and has been largely obtained through this very practical means of study with the Roentgen ray.

Bringing the subject now into our special field, one finds in the current literature and orthodontic text books the following conception of the disease.

Rickets.

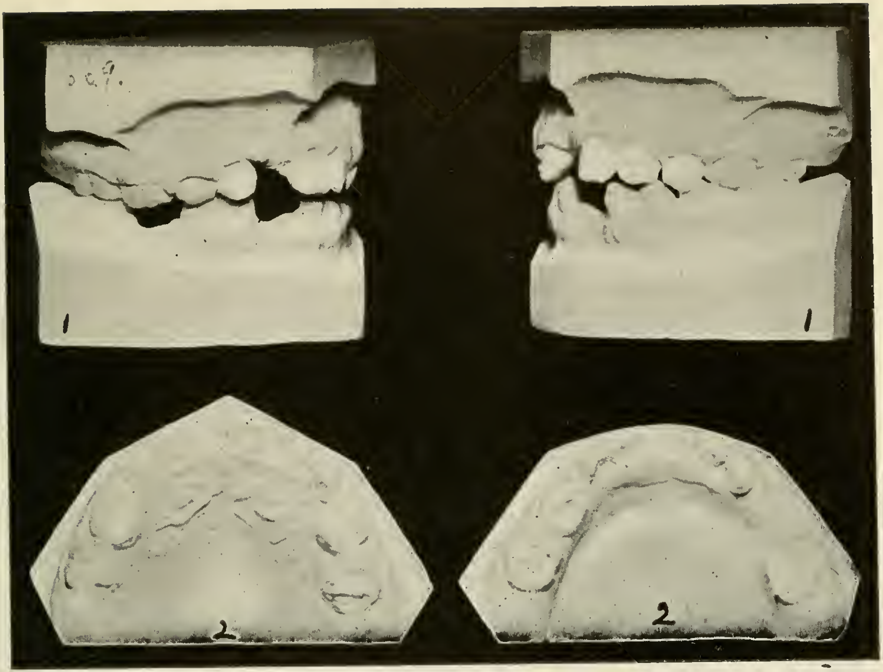
Rickets, characterized by a faulty development of bone, is a very important etiological factor and deforming agent in malocclusions. It delays the eruption of the deciduous teeth which are in turn lost early, with resulting malocclusions in the second dentition. There is faulty development of the alveolar process and of the bones of the mandible and maxilla. The marginal ridges of process are thickened and rounded.

Incisors of the upper jaw are usually small, soft, and friable. Permanent teeth damaged before their appearance show erosions on body and cutting edge. The upper jaw is narrowed or V-shaped in form. Palate high-vaulted and teeth crowded. Lower jaw shortened or trapezoid in form. Upper alveolar processes turn in. Of these signs the narrow or V-shaped upper arch with high vault seems to take first place as a characteristic deformity of rickets.

By way of clearing the ground for further investigation of the subject and that no doubt might exist in my mind as to the presence of these malformations, I examined a group of ricket cases and made models of the jaws of every child in the group.

Material for study is usually easily obtained when once the subject for investigation is selected and planned. It is always to be borne in mind, however, that etiological problems are still so complicated that frequently a subject is chosen for investigation which embraces so large a field that interpretation of the findings is difficult and the meaning of the data obscure. For this reason special effort was made to confine this study to a group of children with a clear diagnosis of rickets, and in which the characteristic deformities of the disease had developed. This group was found in the Massachusetts Hospital School for Crippled Children.

In most of the cases so far as the histories could be obtained the first indications of the disease appeared during the first and second years, and as will be intimated in the description of the illustrations, the deformities resulting were of rather a severe nature and distributed pretty generally throughout the group.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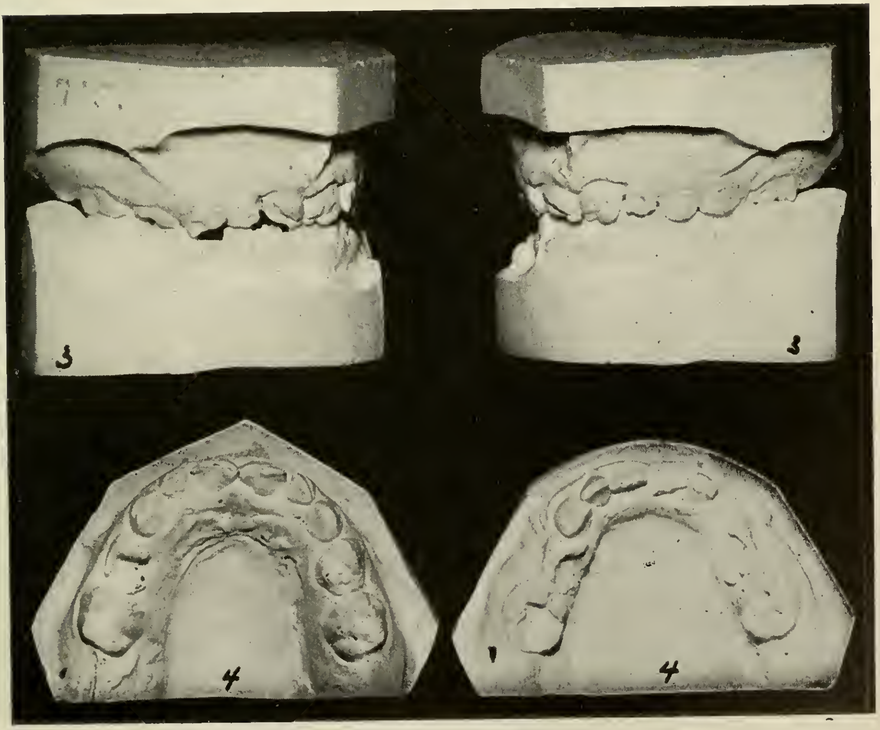
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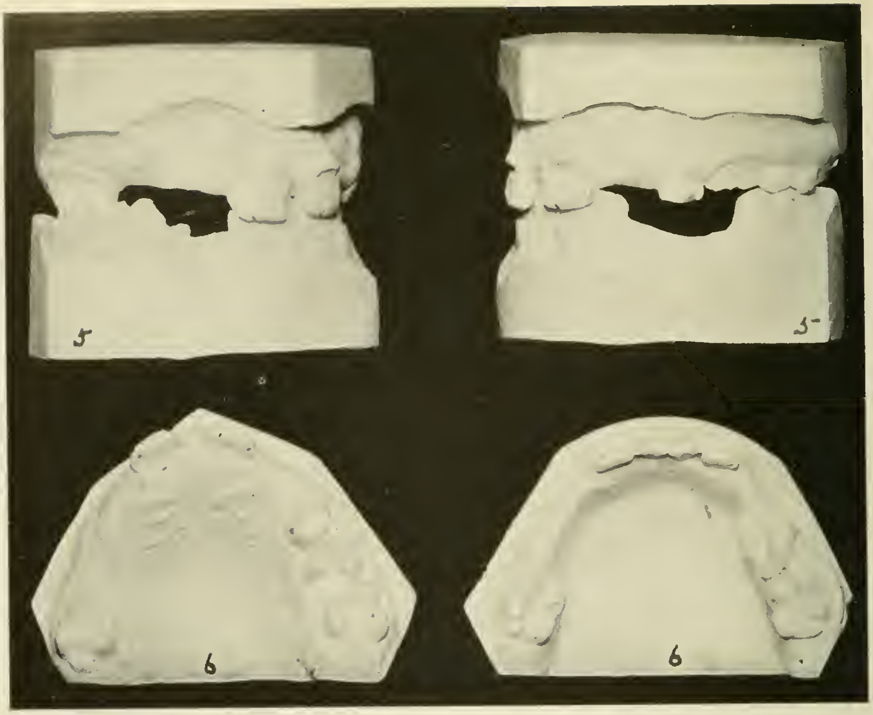
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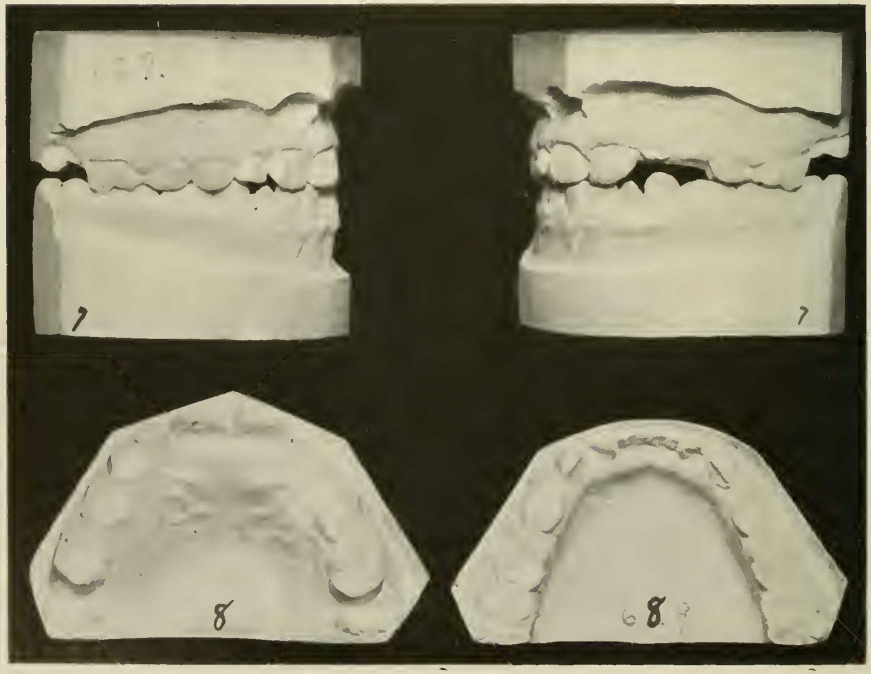
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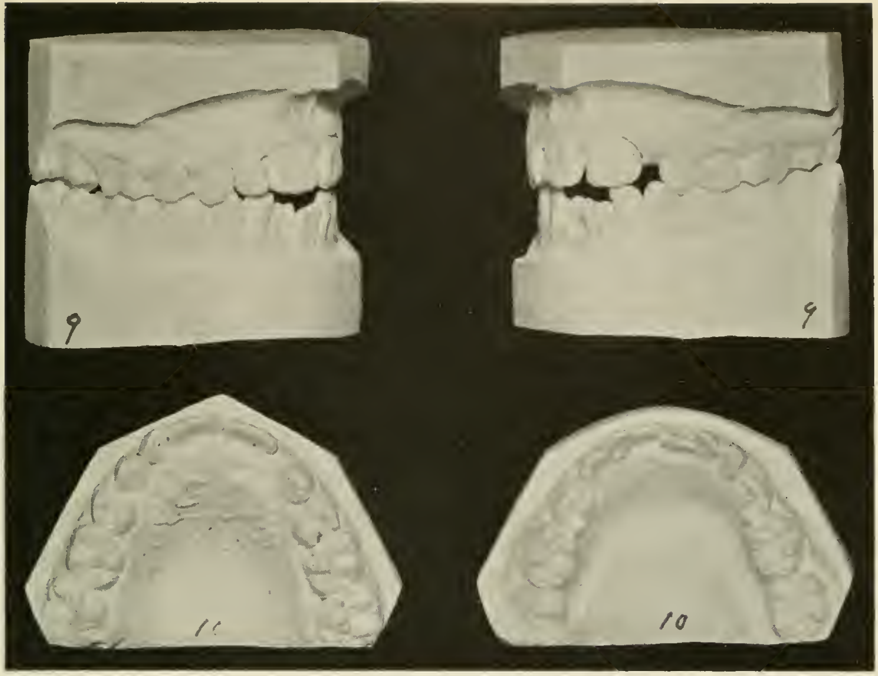
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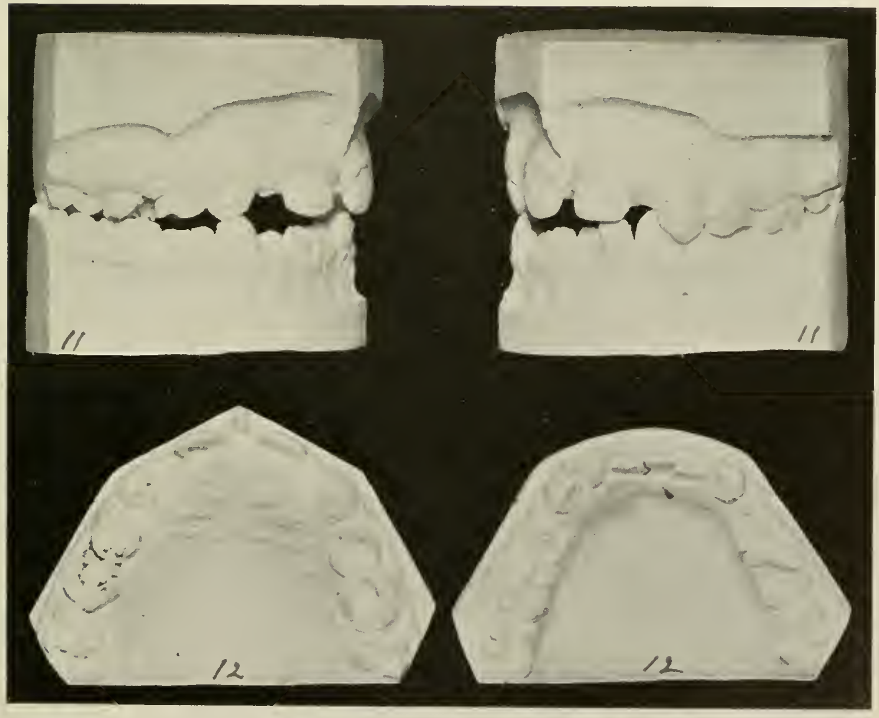
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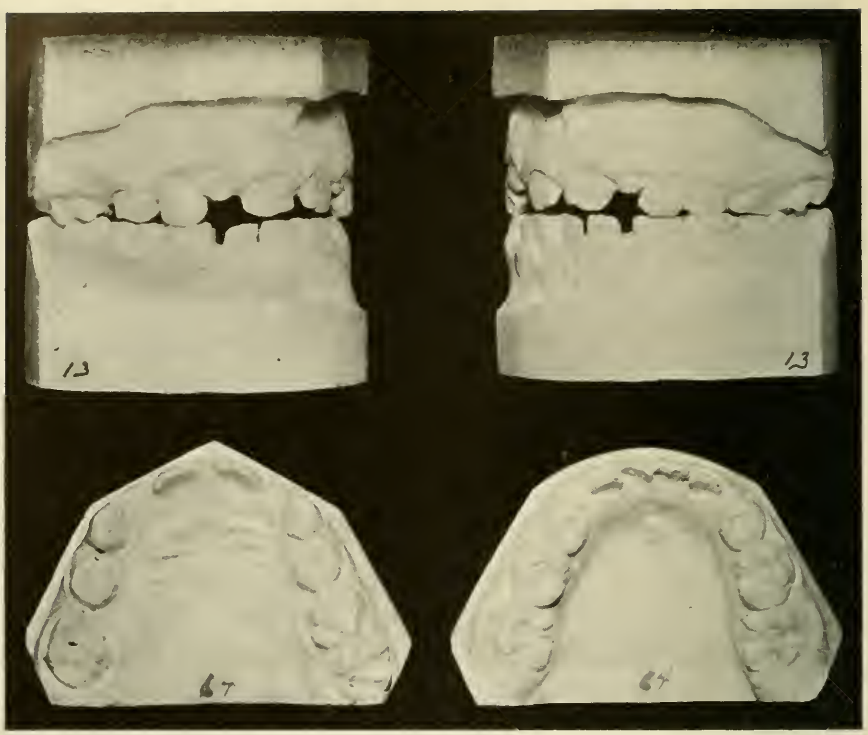
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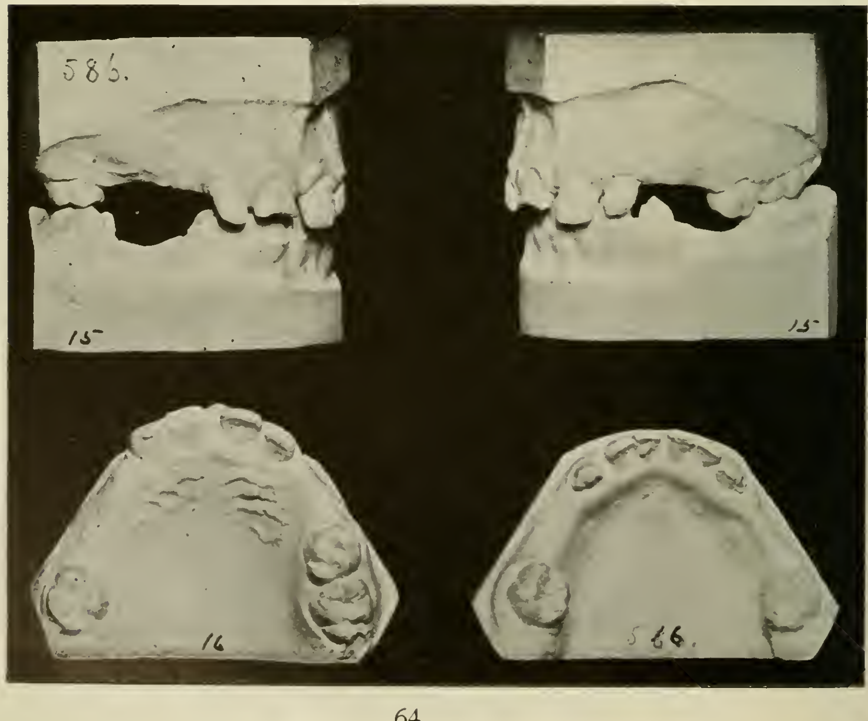
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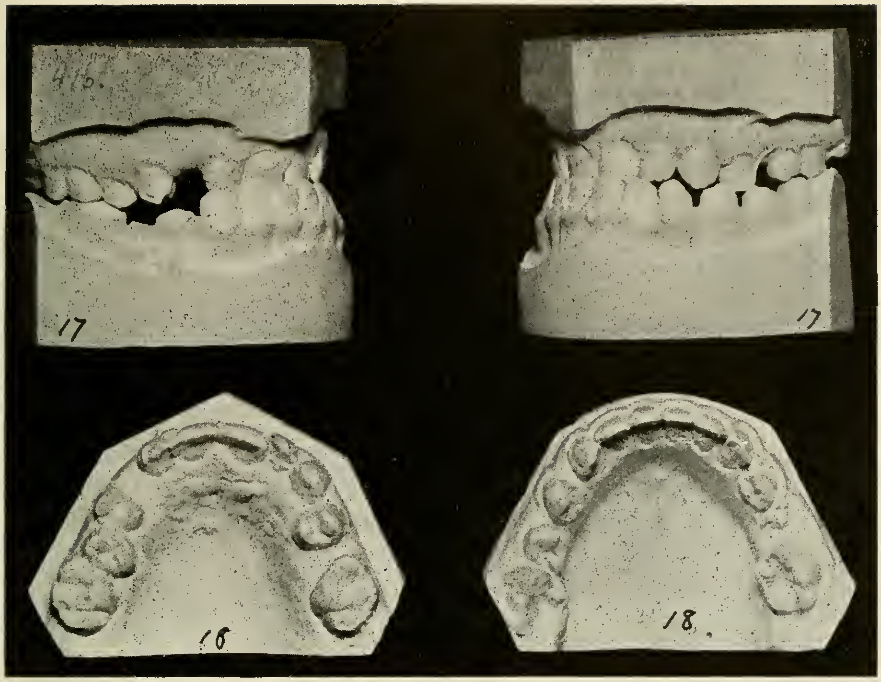
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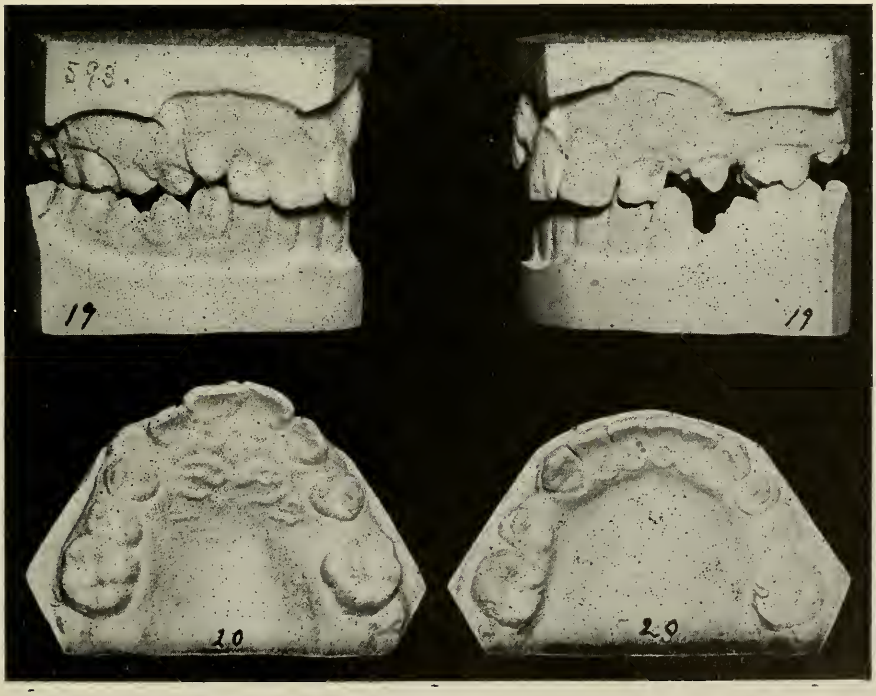
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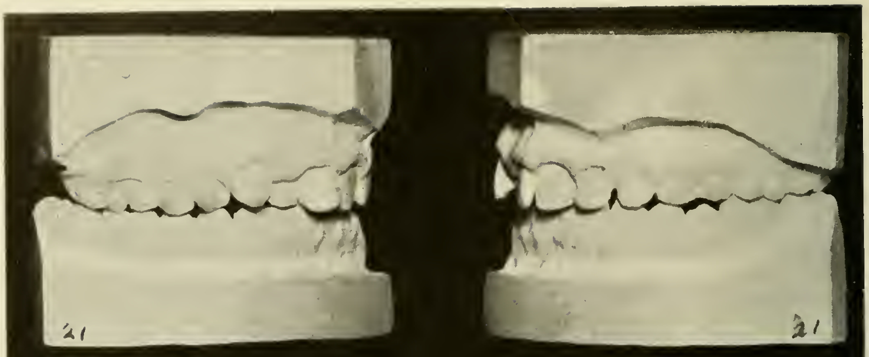
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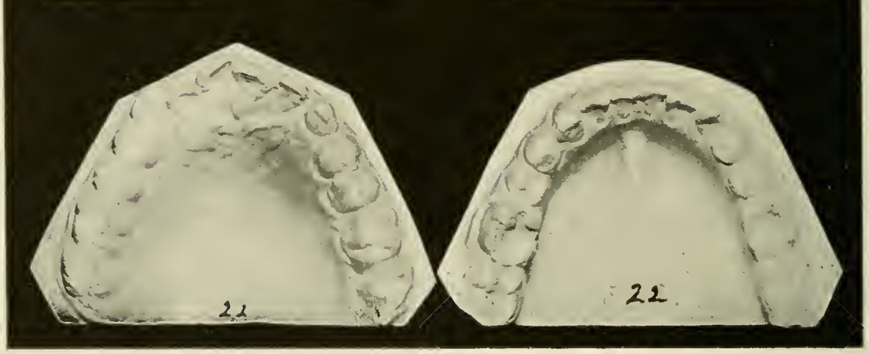
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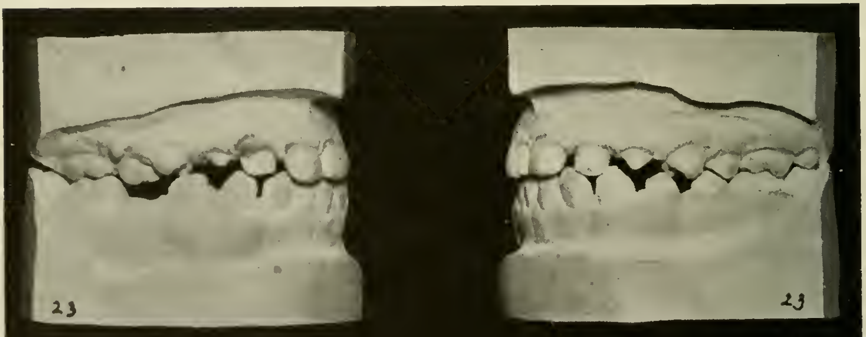
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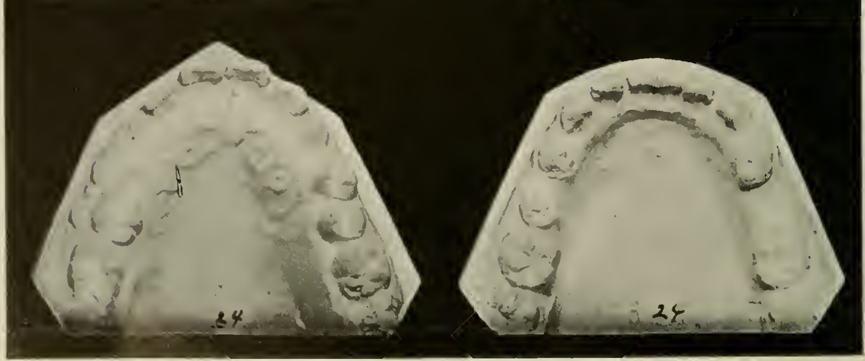
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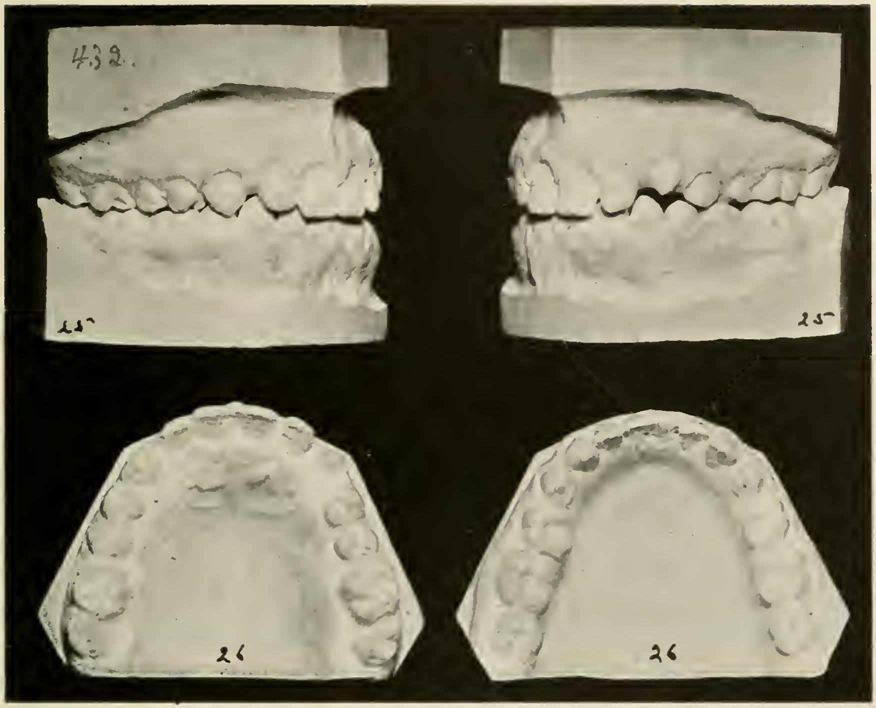
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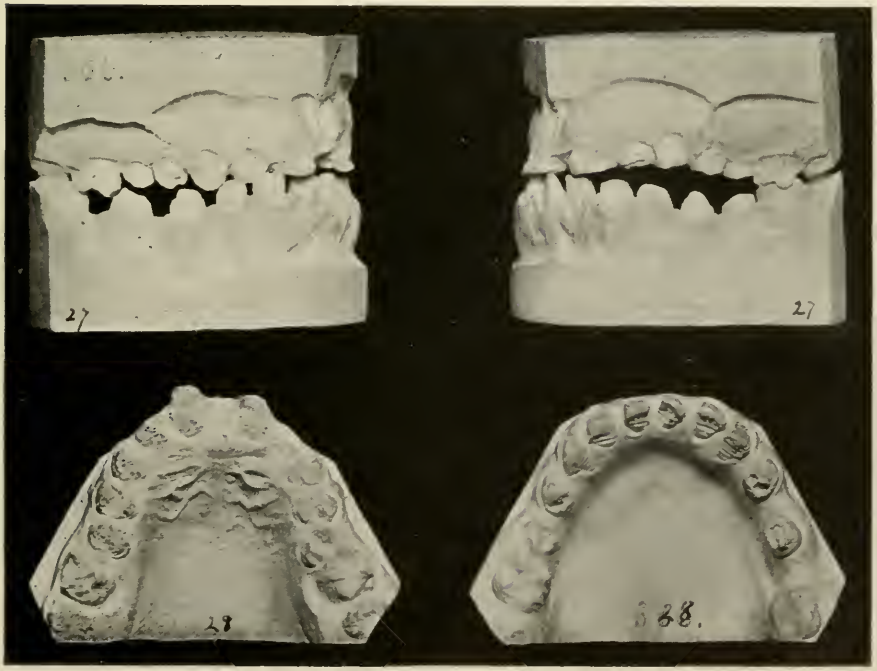
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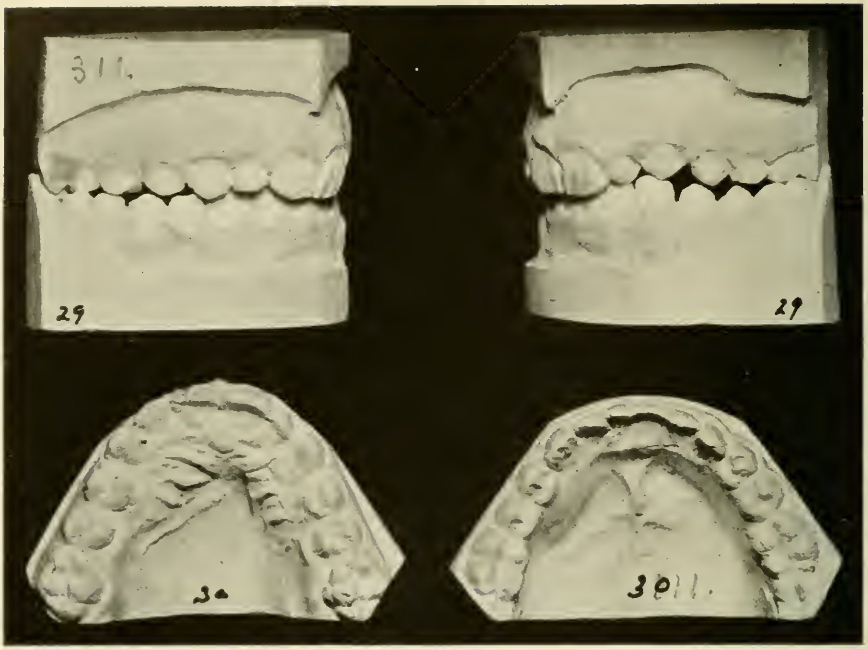

No attempt was made to determine the amount of disturbance in the order and date of eruption of the teeth or premature loss of the deciduous teeth. It would hardly be safe to make a diagnosis of rickets on this feature alone without considering the wide range of physiological variability and the hereditary and individual peculiarities of the child.

It would naturally depend upon the date of the origin of the disease, but where there seemed to have been a premature loss of the teeth, no special disturbance in the development of the jaws was noted.

Furthermore, a careful study of each case seems to show nothing in the nature of jaw formation which might be called characteristic of the disease, and instead of the narrow or V-shaped and high-vaulted palate, the arch forms seemed well within the limits of the normal.

In the 150 children in the school, only 15 cases of rickets were found and I will suggest the severity of each cast as the slides are shown.

Description of Illustrations.

Figs. 1-2. Girl 5 years old, admitted in the hospital two years ago; badly deformed arms and legs, knock-kneed, but no marked deformity in the arch formation.

Figs. 3-4. Girls 5½ years old; normal occlusion; well formed arches.

Figs. 5-6. Girl 7 years old. Admitted in 1916; rather severe case; flabby muscular condition; could not walk when admitted.

Figs. 7-8. Girl 7 years old. Admitted in 1916. Scoliosis, "rosary", and other signs.

Figs. 9-10. Girl 8 years old; very small; had difficulty in walking. Admitted in 1917; jaw development good.

Figs. 11-12. Boy 8 years old; arches well formed.

Figs. 13-14. Girl 9 years old; bad scoliosis; could not walk when admitted in 1913, and was in bed two years in the hospital.

Figs. 15-16. Boy 10 years old; badly deformed back and legs; teeth of first dentition mostly gone; no malocclusion resulting.

Figs. 17-18. Girl 11 years old, admitted to hospital in 1913; upper incisors in lingual occlusion.

Figs. 19-20. Girl 11 years old; admitted in 1916; deformity of arms and legs; some crowding of the teeth and slight pitting of incisors.

Figs. 21-22. Boy 12 years old; admitted in 1915; nothing marked; slight irregularity of upper incisors.

Figs. 23-24. Girl 12 years old; admitted in 1911; very poorly nourished when admitted.

Figs. 25-26. Boy 14 years old; admitted in 1913; bow-legs and other signs.

Figs. 27-28. Boy (colored); 15 years old; badly deformed back and bow-legs; the only case showing marked pitting; scarcely any enamel on any of teeth.

Figs. 29-30. Girl 15 years old; admitted in 1911; case of bow-legs.

As no conclusions are to be drawn from the study of this one group of rachitic children, a few speculative remarks may be permitted. The studies of the disease seem to show it to be essentially an epiphyseal disturbance of the bone, and an interesting question arises as to the existence or non-existence of an epiphyseal cartilage in the mandibular joint.

Piersol (3) states (page 245) "The inferior maxilla has no epiphysis", and further says, "as might therefore be expected the ends of the bones at and near the articular surfaces are usually exempt from disease, in marked contrast to the long bones in which those regions especially suffer."

Alexander Low (4) (anatomy department University of Aberdeen) made a comprehensive study of practically complete series of many human embryos, and concluded that Meckel's cartilage does not enter into the formation of the lower jaw posterior to the incisor teeth, and that at a comparatively late stage in the development of the lower jaw (at the third month of foetal life) certain "accessory cartilaginous" nuclei appear in connection with the primary membrane bone. "There then is a well-defined, wedge-shaped condylar cartilage and a smaller cornoid cartilage. During the later foetal stage up to full term, the jaw rapidly becomes wholly converted into bone, all traces of the coronoid cartilage disappears, while remains of the condylar cartilage perist until birth. Further "accessory cartilages" have no separate centres of ossification, but are replaced by undergoing retrogressive changes, being invaded by the surrounding membrane bone, destroyed by giant cells, and replaced by marrow tissue and trabeculae of bone."

This would seem to have a direct bearing on the question of orthodontic treatment in cases of traumatic injury or ankylosis of the joint after operation. Length growth in some bones depends on the integrity of the epiphyseal cartilage plate, but if growth in the mandible is not of an epiphyseal character the prognosis in these cases would naturally be more favorable.

Regarding the softening of the bones—this may be said to be a characteristic of the disease. The form which the bone takes on as a result of rickets is not typical of the disease but rather that it expresses the mechanical forces acting upon it. For example: The rachitic child is with difficulty induced to walk or play, but prefers to sit with crossed legs on the floor. In this position the mechanical bending force may deform the bone. A bend in the wrist is sometimes seen in the child who has been lead about by its nurse for some time. The weight of the feet and legs projected beyond the edge of a chair is thought to give an anterior bowing of the legs. The mandible is a plastic structure in health, and under the stress of mastication preserves its form; hence in the softening of the bone and with uniform muscular weakness, no change in the bone necessarily occurs. In assuming that the pull of the masseter, for instance, deforms the bone in rickets, you infer that it is the rigidity that resists the pull in health, which is contrary to the physiological nature of bone. If the bone would be deformed as the result of the softening which is characteristic of rickets, then our conception of the normal formation of bone is at fault. We believe that the formation of bone expresses an equilibrium determined by function, that it is molded by the physical forces to which it is subjected, and the muscles acting upon it, and that to *change* the form of bone we must either apply artificial force or stimulus directly or indirectly through *changed* muscular action. We have no evidence, so far as I know, that there exists any changed muscular action during mastication in a rachitic child during the acute stages when the bones may be softened. However, as the work on our etiological problems in the different fields of investigation goes on, it becomes more and more evident that casual information and opinion must give way or be modified as more extensive qualitative analyses are made.

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129 Marlborough St., Boston.

Discussion on the Papers of Drs. Wenker and Hatfield.

Dr. M. N. Federspiel, Milwaukee, Wisconsin.

Dr. Wenker in his paper has covered the subject so completely that it is impossible to discuss it unless one disagrees with some of the views he has expressed.

With reference to the subject of diet, I will endeavor to point out to you what happens in animals when we have dietetic errors. In Wisconsin a farmer had some young pigs that were born without hair. This happened repeatedly, and he sustained quite a loss from a financial standpoint, and appealed to the Agricultural Department of the University of Wisconsin to find out the cause. They investigated it and tried to ascertain the causative factor as to why these young pigs were born without hair and were weaklings and died within a few days after birth. They added potassium iodid to the food at different periods while the sow was pregnant. A number of young pigs were born that were perfectly healthy and lively and had plenty of hair.

The Department of Agriculture and Animal Industry of the University of Wisconsin undertook another investigation. They found that many of the calves on the farms of different farmers were born rickety, with large heads and had pot bellies and were not able to stand several hours after being born. They found that the constant feeding of these cattle with roughage and wheat bran was the contributory cause as to why these young calves were born in that condition and were considered weaklings. By giving them a variety of foods and plenty of roughage they were able to produce calves that were perfectly healthy.

If this is true of young animal life, it can be proven as regards the human being.

It seems to me, we are living in an age in which we are not eating enough roughage; we are eating a lot of sloppy cereals and predigested foods and the offspring are either eliminated or get a rather poor start. So much for diet.

Speaking of syphilis, rickets and various other pathologic phenomena that enter into malformations of the jaw, does it not seem strange that some children born of syphilitics have perfectly normal teeth, and yet they have the syphilitic manifestations in other parts of the body, which goes to prove that syphilis is not a respector of any special organ. It may affect the kidneys; it may affect the brain or the eyes, or it may affect the teeth. The child may have an iritis from a specific cause, although it may have a normal denture.

Dr. Hatfield showed us the slide of a patient who had been five years in the hospital suffering from rickets. I would call the mouth fairly normal in that case. There was no further discussion.

Radiodontic Examination With Special Reference To Localization of Unerupted Teeth

By Clarence O. Simpson, M. D., D. D. S., St. Louis.

The evolution of modern orthodontia from the pioneer operations, the scientific study which has been applied to this development, and the wonderful transformations produced by orthodontic treatment, is a source of inspiration and pride to observing members of the dental profession. Orthodontists deserve the credit of contributing to the profession their observations on the basic principles of occlusion, and the far-reaching effects of malocclusion which have markedly broadened the conception and improved the technic in most branches of dental practice. No more striking exemplification of the favorable results of concentration in a limited field of endeavor is evident than in the practice of orthodontia.

It is unnecessary to offer a plea before this society for the advantages of specialization, since all of you have chosen this course. Your personal experience has strengthened your convictions, and your accomplishments are abundant proof of the efficiency of limited practice. As practitioners of one of the first established specialties of dentistry you are asked to consider what claim radiodontia, one of the recent specialties, has for recognition, and of what service it may be to you. While a few orthodontists have done notable work in radiodontia, most of you have been in the same position as the general practitioner of dentistry in this matter. Until recently, the dentist, orthodontist, and exodontist have referred radiodontic examinations to a general radiographer of medical or laboratory training, who has attempted to dignify or mystify his vocation by publicly proclaiming himself a disciple of Professor Roentgen, but who has attached little importance to dental radiography. The other alternative exploited by the energetic optimistic salesman has been the installing of radiographic equipment, and endeavoring to become proficient in the operation of it; or worse, delegating the work to a lady assistant. Rarely has either of these methods proved satisfactory, or given the dentist or orthodontist adequate service.

The general radiographer is handicapped by a lack of familiarity with dental operations, and has such a volume of diagnostic and therapeutic work that dental examinations can not be given the deserved attention. The dentist, being inexperienced in radiographic diagnosis, has not insisted upon better service as have the physician and surgeon, and service is seldom more efficient than the demands made upon it. If the dentist succumbs to the propaganda of the manufacturer and installs radiographic equipment, he will be obligated to an investment and maintenance expense for which he probably will not be directly compensated in fees, and he will be compelled either to utilize an additional room or to convert his operating room into an equipment display. Unless he will devote equal time and study given to any exacting technic, his results will be inferior, and if he attempts to train an assistant for the entire operation he is likely to complicate the situation and cloud the diagnosis.

Radiodontia as a Specialty Advocated.

The choice of ways and means is a matter of individual opinion, but the radiographic results of different methods are not influenced by personal prejudice, they are vivid records always subject to comparison. Discrimination of radiographic films and plates is developed by critical study of them; the average standard is far below existing possibilities, and nothing short of the maximum information obtainable should be tolerated. Dental and oral radiography has been a neglected and undeveloped field, and the orthodontist has not received the proper co-operation in radiodontic examinations, nor has he sufficiently utilized this indispensable adjunct to orthodontic treatment. In view of the development of any art or science from specialization or intensive application, it is a logical conclusion that the limited practice of radiodontia will produce decided progress in dental radiography.

Some orthodontists believe that they can photograph their patients to best show improvements in facial contour from the correction of malocclusion, but excepting stereophotography, it seems more of a conceit than a necessity. It is possible that the professional photographer would not obtain the striking "before and after taking" effect including coiffure, sartorial embellishment, and expression, sometimes observed in photographs of these cases, but with proper instruction he should supply uniformly accurate records. The orthodontist with sufficient practice to occupy his time who undertakes radiodontia is likely to appear in the same aspect, and secure results similar to the busy dentist who attempts orthodontia. If to orthodontia, art, engineering, and prophylaxis, is added photography and radiography, we may tax our versatility and become a "one-man organization," rivaling the activities of the drummer in a "jazz" band. During the early development of dental specialties necessity may have compelled lax restrictions in lim-

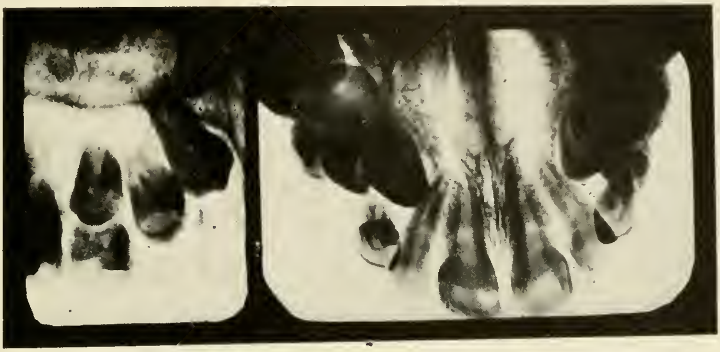


Fig. 1.

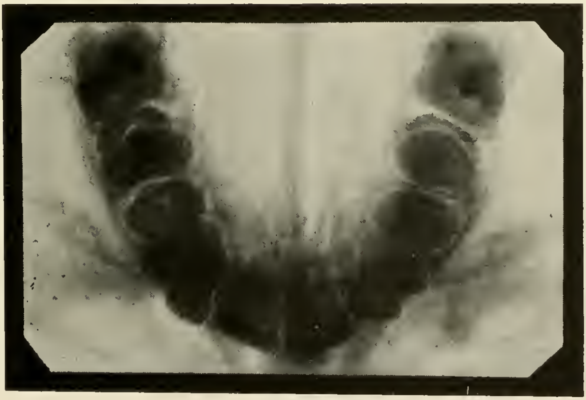


Fig. 2.

ited practice, but in the future, combinations of orthodontia, exodontia, periodontia, or radiodontia, may arouse suspicions of commercialism and a questioning of altruistic motives.

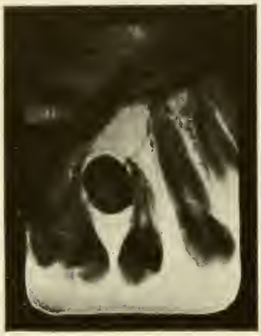


Fig. 3.

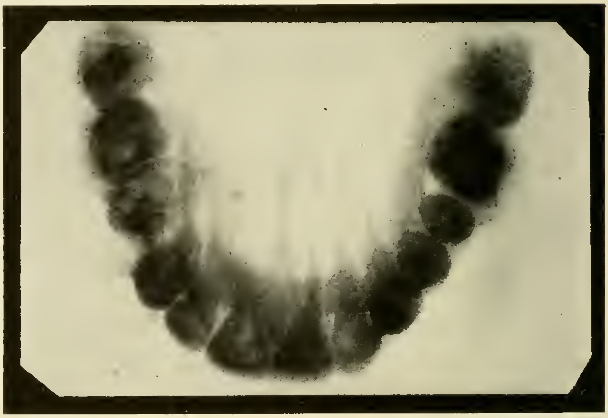


Fig. 4.

Radiodontic Requirements of the Orthodontist.

The fundamental requirements of radiodontic examination for the orthodontist are: determining the absorption of deciduous teeth, and the presence, location, position, mesio-distal diameter of crowns, and degree of development of the permanent teeth. This does not constitute a formidable number of requirements, but in view of the limitations in radiographic technic, and the difficulty of securing immobility and co-operation from young patients, it demands qualifications which combine speed, legerdemain, and hypnotism. During secondary dentition every child should have a radiodontic examination at least once each year to determine the indications for exodontic or orthodontic treatment. The orthodontist who ignores the opportunity of supplementing clinical observations and physical examination with routine radiodontic records may be classed with the dentist who makes every diagnosis by subjective symptoms and swelling.

Decalcification of deciduous teeth may not progress normally, and radiodontic examinations will indicate the removal of deciduous teeth which are retaining or deflecting the successors. Caries or pulp involvement often suggest the removal of deciduous teeth which radiodontic examination shows should be retained for maintenance of space to accommodate the arrested development or delayed eruption of the permanent teeth. With a difference of opinion which is characteristic of authorities upon any subject, tables for the period of eruption not only present a latitude of two or more years, but vary quite materially. A discrepancy of two or three years between anticipation and manifestation is sufficient to wreck the occlusion. Prophylaxis, the ultimate in operative dentistry, is also applicable to orthodontia.

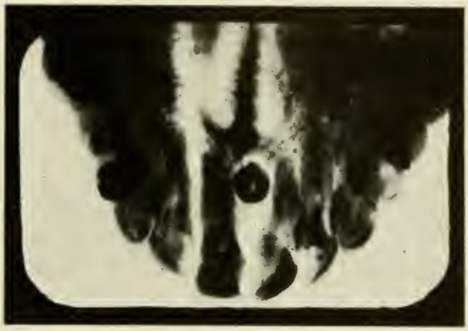


Fig. 5.

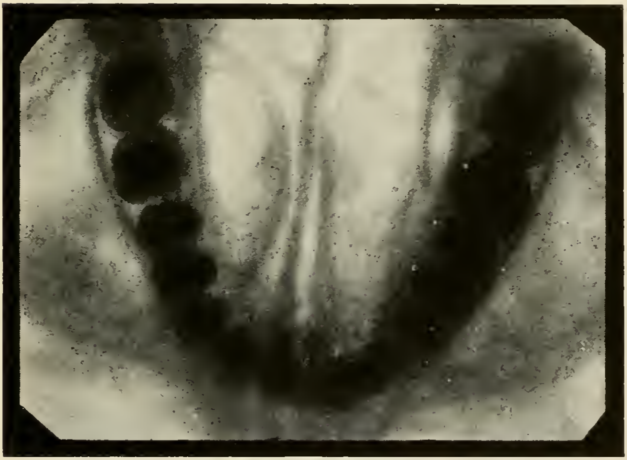


Fig. 6.

The presence or absence of permanent teeth sometimes becomes of critical importance to the orthodontist who has applied treatment with a sublime faith in nature "running true to form" and supplying the normal quota of teeth. The congenital absence of teeth is not sufficiently rare that it may be disregarded and the early knowledge of it, secured through routine radiodontic examinations, would modify treatment and avoid chagrin and humiliating explanations. Lamentably too often radiographic examinations supply little exact information beyond establishing the presence of teeth, which is inadequate for rational orthodontic procedure. The relative location and position of unerupted teeth must be determined to form a prognosis and choose methods to assist the teeth into normal occlusion. The interpretation of a plane, radiographic film, or plate, is misleading in direct proportion to the divergence of teeth from normal position.

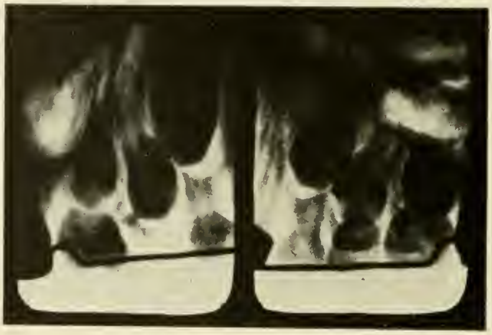


Fig. 7.

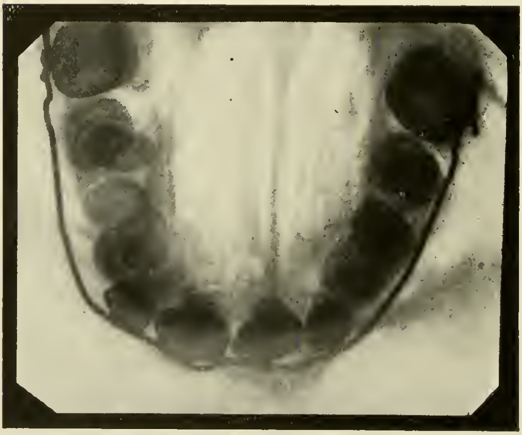


Fig. 8.

Stereographic Radiography of Little Value.

Textbooks which are often as amusingly antiquated as ladies' fashions of a former period, lamely advocate stereo-radiography, for localization of malposed teeth. Stereographic intra-oral films are difficult to produce under favorable conditions, which are rarely presented by children. When obtained, they only add perspective, with its possibilities of illusion, and the disappointment in attempts to distinguish the relative position of small objects in comparative proximity. Precision in determining form and location is attained by viewing the object in two or more planes of the three dimensions. In the standard technique for intra-oral films, the rays are directed from the buccal or labial at a variation of 45 degrees in a mesial or distal aspect and at a variation of 25 degrees toward the vertical or horizontal plane. This is often insufficient to ascertain the outline of malposed teeth and totally inadequate for localization.

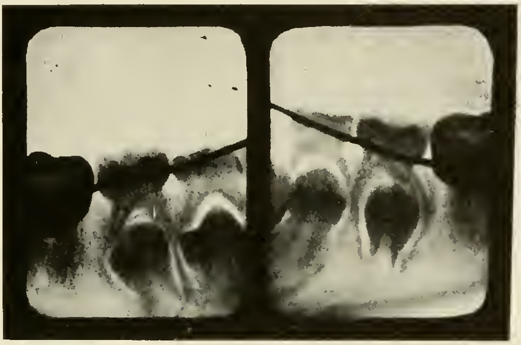


FIG. 9.

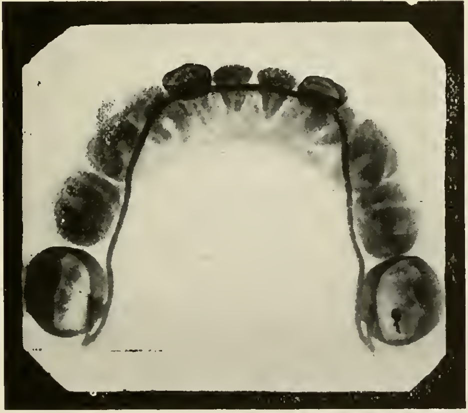


FIG. 10.

Radiographic Method for Locating Teeth.

The method herewith proposed is the extension of the vertical—horizontal arc from which the rays are directed, from 25 degrees to 90 degrees in either dental arch, permitting various views from both lingual and occlusal aspects. To a limited degree this method has been used for the mandible, but no mention has been observed of its use for the superior maxillae. The technique employed is the use of films slightly larger than

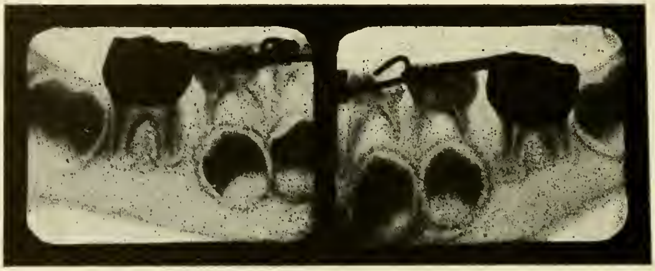


FIG. 11.

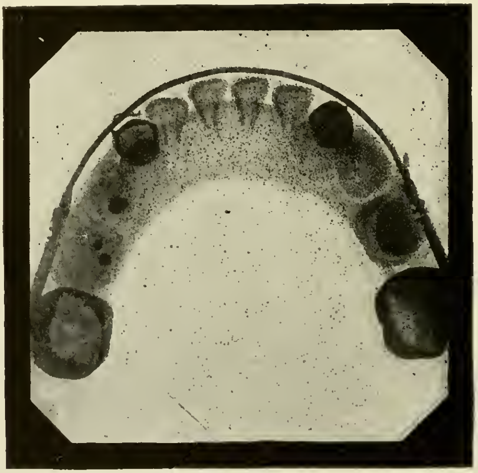


FIG. 12.

the arch, placed on an aluminum base to obtain a flat surface and prevent distortion. The film pack is carried distally to the anterior border of the ramus and the teeth occluded on the metal and pack to retain it. For the lower arch the patient is posed with the head thrown backward to a horizontal position permitting the rays to be directed at right angles to the occlusal plane of the arch. For the teeth in any particular region a smaller film is used and the rays directed parallel to the long axis of the teeth. For the upper arch, with the head in a vertical position, the rays are directed downward through the parietal bones, slightly anteriorly to a perpendicular of the film for the entire arch, or directed parallel to the long axis of any tooth. This produces an occlusal view which, in connection with a lingual view, determines the location, position and the approximate form of the teeth, supplying highly important data for the orthodontist. Young patients are especially adaptable to this technique, since it eliminates the digital retention of the film and the discomfort to the soft tissues in the floor of the mouth. An appeal to the competitive spirit by reference to a mythical little girl, who accommodated a much larger film, will secure a startling buccal capacity, and the average child, from prehensile instinct, will bite even when instructed to the contrary. The same care must be

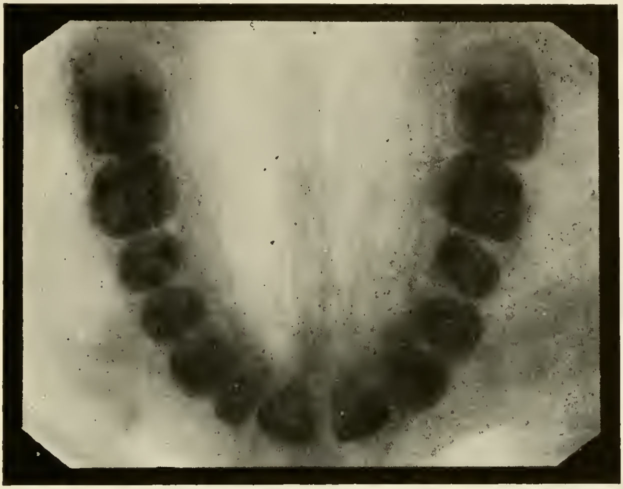


Fig. 13.

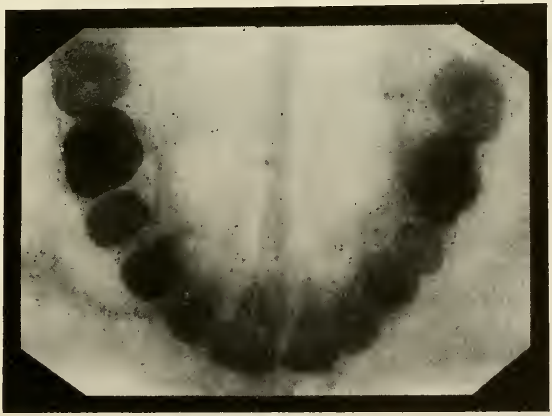


Fig. 14.

exercised in making the examination through the skull, as in sinus examinations, limiting the exposure to the minimum to obviate the danger of alopecia.

The opportunity to ascertain the size of the secondary teeth before eruption should be of great practical value to the orthodontist, and this may be accomplished with great accuracy by radiographic records.

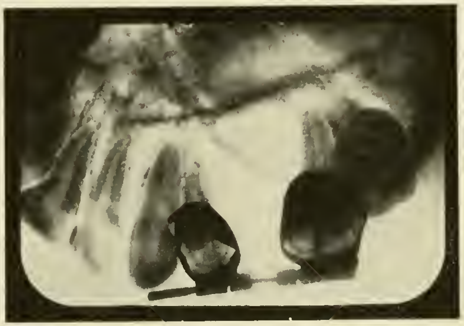


Fig. 15.

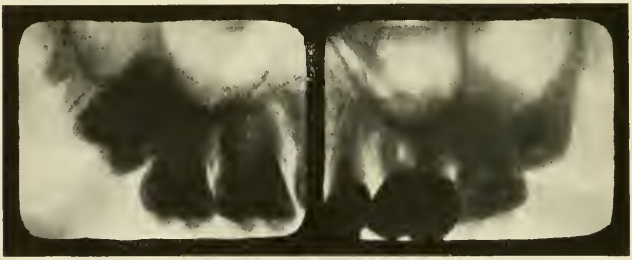


Fig. 16.

With a fine focus tube, a target film distance of 18 inches and the tooth one inch from the film, the image is not enlarged to any practical degree; about two-tenths of a millimeter. The mesio-distal diameter of each tooth may be determined by the occlusal view, and the permanent arch charted long before eruption of the teeth. This permits preliminary treatment to accommodate the secondary dentition, and is of special value in securing and maintaining space for the delayed eruption of one or more teeth.

These details are presented for the consideration and discussion of this body, to obtain an appraisement of the practical value of thorough radiodontic examinations for the orthodontist, and to stimulate suggestions for improvement in this phase of radiodontic practice. Cooperation between practitioners of specialties so intimately related as are those of dentistry, is mutually advantageous and a potent factor in the progress of dental science. Radiodontia is in a plastic state of its development and will conform to the demands and ideals of the dental profession; may it not have the inspiration of your confidence, constructive criticism, and guidance?

Description of Illustrations.

Fig. 1. The usual method in attempts to determine the location and position of unerupted teeth. The small film is a lingual view through the bicuspids, and the larger film was retained between the teeth while the rays were directed downward and backward through the base of the nose, the latter producing only a lingual view with inferior detail of the incisors, and a vague conception of the bucco-lingual position of the bicuspids.

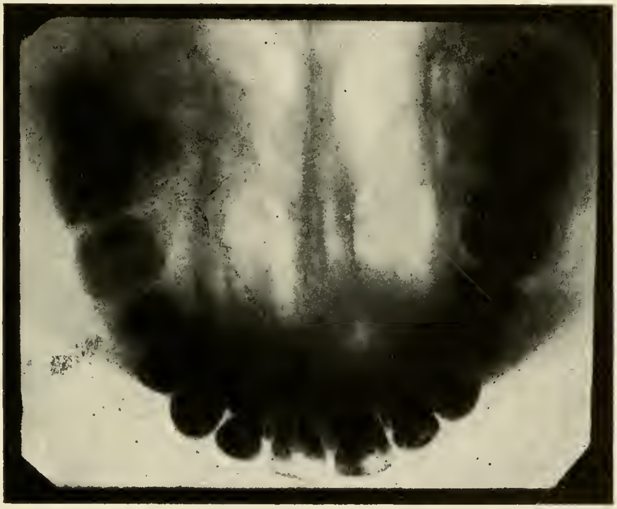


Fig. 17.

Fig. 2. A true occlusal view of the same arch in which the bucco-lingual and mesio-distal relationship of the teeth are shown. This in connection with the lingual views to determine the distance of erupting teeth from the occlusal plane supplies data for localization.

Fig. 3. A partially developed malposed bicuspid through which the lingual view parallels the long axis, leaving the observer in doubt as to whether the crown is presented buccally or lingually.

Fig. 4. This occlusal view discloses the position, and the bucco-lingual location which could not be determined from the lingual view.

Fig. 5. A supernumerary, the development of which resulted in traumatic devitalization of the left central. Although it appears to be wedged between the centrals, there is uncertainty as to the form and exact location.

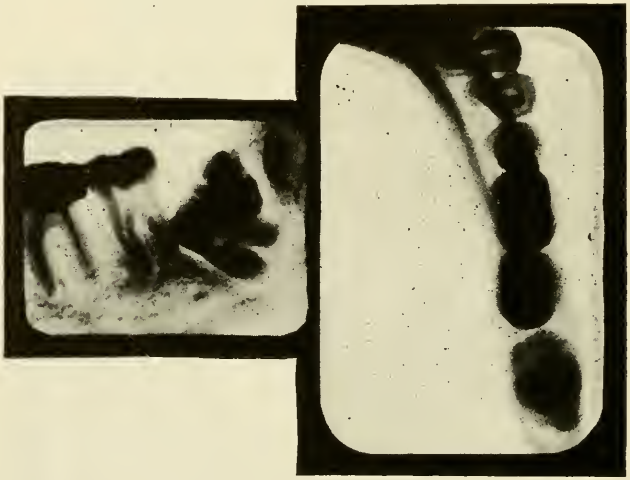


Fig. 18.

Fig. 6. This aspect facilitates surgical procedure by showing it to be rudimentary in development and lying to the lingual of the central incisors.

Fig. 7. Lingual view of secondary dentition which does not establish the bucco-lingual relationship of the teeth.

Fig. 8. Occlusal view which completes the localization of unerupted teeth in Fig. 7.

Fig. 9. Lower bicuspid regions of same case as Figs. 7 and 8.

Fig. 10. Occlusal view of entire lower arch, which established the relative location of the erupting teeth in Fig. 9.

Fig. 11. An excessive application of intermaxillary force in a Class III malocclusion which has resulted in a distal inclination of the first molars.

Fig. 12. Occlusal survey of the case in Fig. 11.

Fig. 13. A thorough inspection of the maxillae, which, in connection with the history, conclusively proves the congenital absence of a lateral incisor. To exclude the possibility of a migratory tooth by the elimination process of former methods requires several lingual views and extra-oral plates.

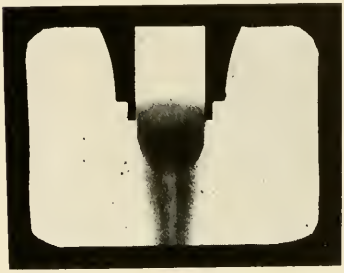


Fig. 19.

Fig. 14. Congenital absence of two upper bicuspids.

Fig. 15. Radiographic examination neglected while space was retained two years for a bicuspid which did not exist.

Fig. 16. Two upper malposed unerupted third molars, which were suspected of being the source of reflex disturbance.

Fig. 17. This occlusal view of the third molars in Fig. 16 establishes the location and position for the exodontist.

Fig. 18. A clinical diagnosis of "bone tumor" was made, and an alleged operation performed seven years previous to this examination, which determines location of an odontoma from a lower third molar.

Fig. 19. Illustrates the accuracy with which the size is recorded by a fine focus tube at a long film target distance. The calipers adjusted to the exact width of the tooth rest on the film, while the tooth is suspended one inch above.

Discussion of Dr. Simpson's Paper.

Dr. E. G. Weeks, Saginaw, Michigan.

Mr. President and gentlemen: A year ago Dr. Kells gave us a very beautiful paper. The doctor, as I told him personally, went into this too deeply. He used a tube stand, home-made; it has stereoscopic adjustments and all movements necessary to produce beautiful radiograms, as you gentlemen know.

When Dr. Kells finished his paper, one of our members finished the evening in discussing terminology, and we knew, perhaps, after it was all over, that telegraph, telephone, photograph and several other "graphs" came from some Greek "graphs," but we did not get a thing that Dr. Kells wanted to impart to us. Dr. Kells attempted the localization of impacted teeth stereoscopically. I told him then that he could locate them much more easily by taking two views of the same location from two different angles. Now, we all strive to improve in our work, and if we feel we are original in finding some way of getting better results in an easier way than the other fellow does, we should be willing to give to each other these ideas as soon as possible.

I did not know, when Dr. Kemple asked me to discuss this paper of Dr. Simpson's, just how Dr. Simpson locates or localizes teeth. I thought that he would present to us something similar to Dr. Kells's idea, and I made up my mind to bring on a few slides to show why I thought my way the best. I wanted to "beat someone to it."

Dr. Simpson invited me out to his office last Saturday, and I found my idea—at least I thought it my idea—as I had never seen it before, in use by Dr. Simpson. I saw many beautiful radiographs. Dr. Simpson is taking great pride in his work and deserves much credit.

I must say that I do not agree with the doctor when he says, "we will become a one-man organization, rivaling the drummer of a jazz band," if we take our own radiographs and photographs; why does he not also add, taking impressions?

Now, why do we take impressions? We must study our case from every angle, inside and out; we must get histories, not only of today, but of early conditions as far back as birth, and even before, in some cases. If this is so, we take impressions of all the structures we can get in the plaster. Years ago this was enough; today it is not. We have seen the mistakes in the guesswork of our older men, and we must profit thereby. Missing supernumerary, impacted and malposed impacted teeth; we must know, not only that these conditions exist, but their exact locations.

I have heard an efficiency man of some note make the statement that "an operator who does anything away from the chair that can be done by his assistant is as far behind the times as is the business man who writes his letters in long-hand." I believe him. We take impressions of the mouth, give them to our assistant, and she does the rest. Now, is it not our duty to take the radiographs and photographs and let her finish them? It can all be accomplished in a very short time, and we can sit down at our study table; first study the teeth as they occlude, then, if any teeth are missing, we can reach over to the X-ray light box and see at a glance just what condition we will have to combat.

I believe that every case that presents for examination should be examined, not glanced at and shot at in the darkness of guesswork.

Dr. R. J. Wenker,
Milwaukee,
Wisconsin.

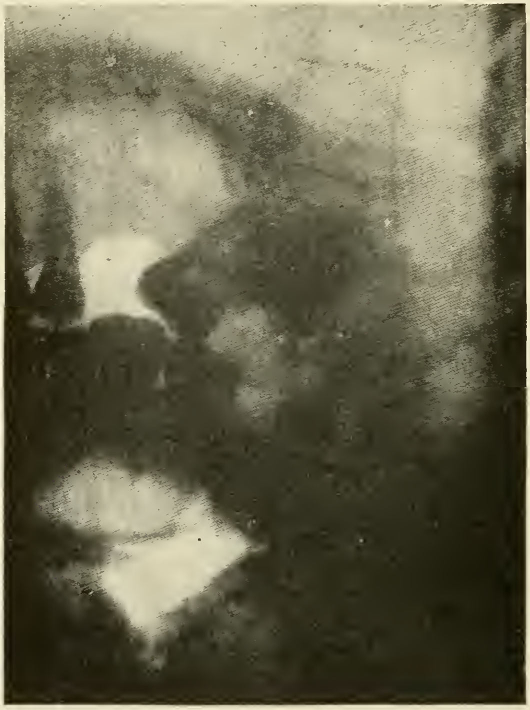
In connection with this discussion of localization of impacted teeth, I would like to report a case of unusual interest.

In April, 1916, an exceedingly interesting case came into my hands in the person of a dentist, about 40 years of age, who had an impacted upper third molar operated upon three successive times within a period of three days, and in which the tooth had become lost in the soft tissues at the first operation. The tooth was originally located in a perpendicular position, immediately distal of the second molar, and completely covered with soft tissues. The first step taken by the surgeon in charge of the case was to secure a good radiograph. Local anesthesia was used, and in the attempt to tip the tooth out of the socket by means of elevators, it became lost in the soft tissues posterior to and above its original position. This operation was performed at the surgeon's office, and immediately following the accident the patient was transferred to the hospital, and in the afternoon of the same day, under ether anesthesia, a futile attempt was made to recover the tooth. After a lapse of one day another radiograph was taken, and the tooth was indicated at a point lingually and slightly anterior to the upper extremity of the coronoid process of the mandible. The same day another futile attempt, under ether anesthesia, was made to recover the tooth.

Three days after the last attempt, I was called in to take charge of the case. My first effort was made to combat the infection. The face and side of the head were extensively swollen, the pulse was rapid and very irregular, and the temperature was 102.

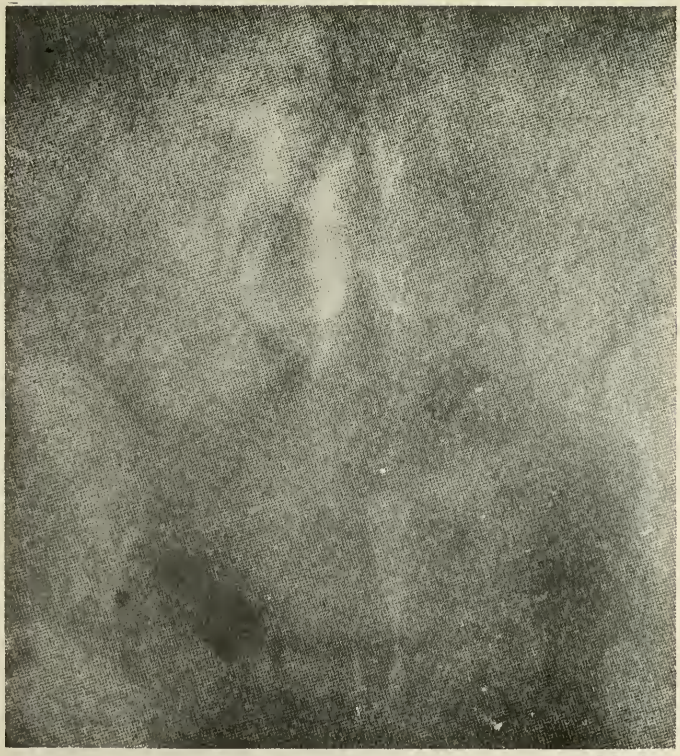
The upper margin of the swelling was sharply outlined by an abrupt termination along the line of the bony attachment of the temporal muscle. This gave me the suggestion that the tooth was pushed beneath this muscle, which in my subsequent examination proved to be true.

The infection was combated by frequent irrigation of the wound back of the second molar and up as high as the irrigating tube could be extended without extreme pain. This irrigation was the first the wound had received, although six days had elapsed since the first operation. Besides the irrigation, very hot boric acid packs were applied continuously, day and night, except while sleeping, for two weeks. At this time the patient was in a satisfactory condition to take to my office, and take radiographs to locate the much-sought-for tooth. Fig. 1 is an illustration, showing the original position of the tooth. Fig. 2 is an anterior-posterior view, and is my first effort to locate the tooth. At this time it occurred to me that a silver wire, inserted as high as possible into the wound and ligated to the buccal surfaces of the bicuspids and molars, would be of some assistance in locating the tooth. Fig. 3 is a side view with wire inserted. Note that the tooth is manifest



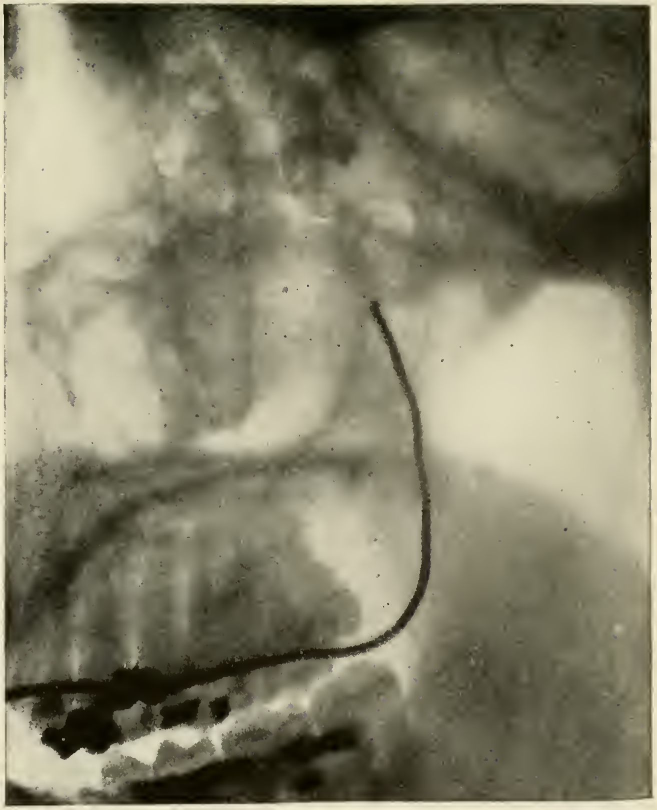
Wenker

FIG. 1.



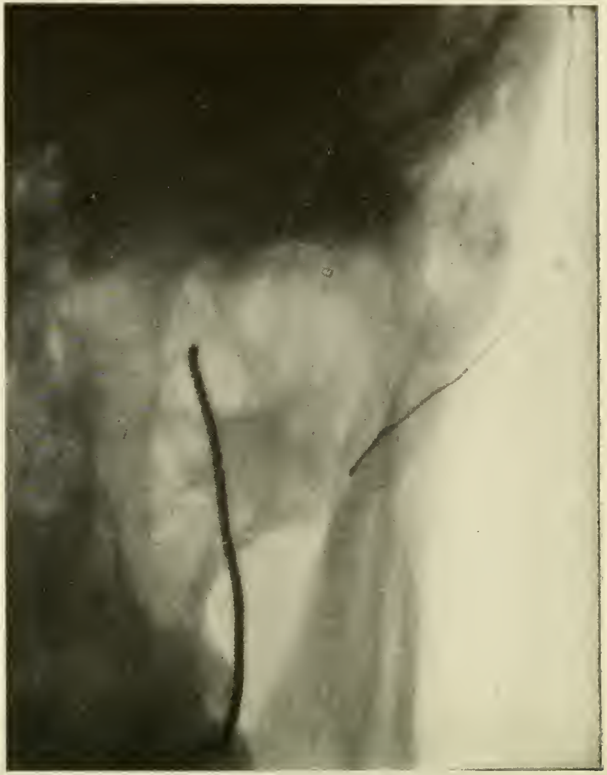
Wenker

Fig. 2.



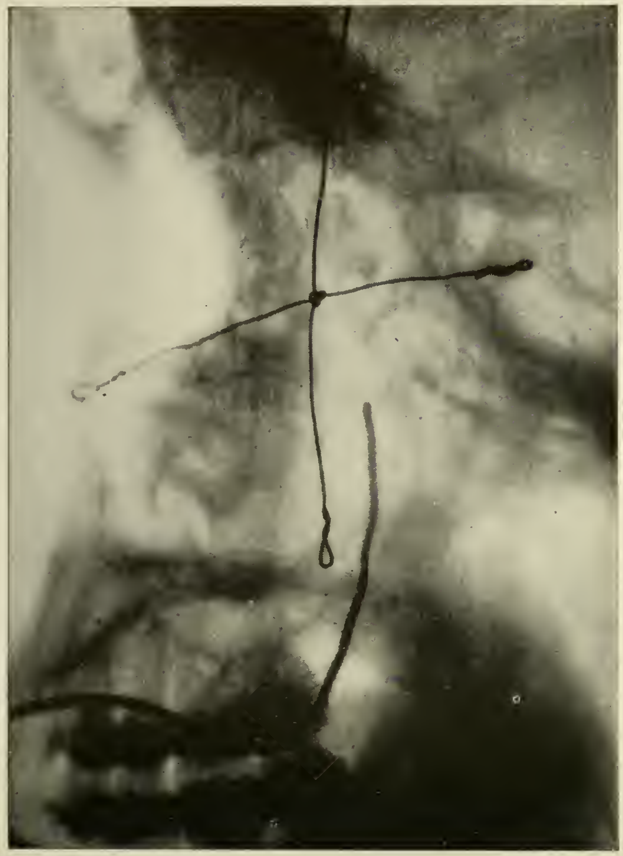
Wenker

Fig. 3.



Wenker

FIG. 4.



Wenker

FIG. 5.

in the lower and anterior portion of the temporal fossa, beneath the zygoma and about one inch posterior to the anterior border of the external orbital margin. The following day this view was repeated by reinserting the wire in the mouth wound, and using Fig. 3 as my guide, a cross was made of silver wires located on the outside as nearly over the tooth as possible. This view is shown in Fig. 4. In Fig. 5 we have an anterior-posterior view, with the same wires in place. In the two latter figures the tooth has been outlined with a lead pencil to bring it more clearly to view.

In the removal of the tooth, sixteen days after taking charge of the patient, ether anesthesia was used, and a skin incision was made above the zygoma and just anterior to the hair line. By blunt dissection the temporal muscle was exposed and split. Then a search for an hour and a quarter was made for the tooth. After nearly despairing in my effort to find the tooth, I recalled that the tooth shows a slightly different position in Figs. 4 and 5. This was probably due to movement of the temporal muscle over the incline formed by the external surface of the skull beneath the zygoma where the tooth was lying. The muscle movement caused the tooth to move to a more anterior position into a deeper part of the fossa. I therefore placed my index finger into the mouth wound, and strained and searched until I located the tooth with my finger-tip, and while maintaining this digital contact the tooth was removed with a pair of hoemostats, through the external incision.

There must have been some leakage through the gum tissue, admitting infection to the impacted molar, to explain the existence of caries in the crown of the tooth. This cavity on one side of the tooth and a hook on the end of the root on the other side helped to hold the tooth in each new position as it was pushed up into that location. I might add, that it is very easy to lose a tooth in the manner and location where this one was lost. If you do not believe it, try it. Such a tooth can easily travel between the pterygoid muscles on one side, and the ramus of the jaw on the other side, until it reaches that position. It did not pass through any muscle, but between them and other structures, and it is an easy place to get a tooth into. Only a slight amount of pressure is necessary.

Dr. George B. Winter, St. Louis. I have enjoyed the paper of Dr. Simpson very much, and desire to compliment him on the able manner in which he has presented the subject. The diagnosis of impacted teeth is very important. I was particularly interested in the slides of the case showing the occlusal plane of the tooth without any root formation.

It is not uncommon in a case of impaction of a lower third molar to have a complete lingual displacement. When the X-ray operator, following a certain procedure as to position of both the tube and patient for impacted lower third molars, determines that the tooth is lingually displaced, another film should be inserted, and a radiograph made as when radiographing a superior third molar. In following this method, all of the root of the tooth is brought out in the picture, and the entire detail of the root formation is presented.

I have seen many cases of impacted teeth where the pressure was on the distal surface of the second molar to such an extent that there was no contact between the second and third molar. In addition, in such cases there is usually a destruction of the peridental membrane on the distal surface of the third molar, and it is not uncommon to find an exposure of the tooth pulp on account of the pressure caused by the impacted third molar.

The accident in the case of an upper third molar, as presented by Dr. Wenker, is of common occurrence. It occurs also when the lower third molar is impacted and the entire lingual plate has been destroyed, with a pathologic condition prevailing. Where any pressure is created buccally on the third molar and the lingual plate has been destroyed, the tooth is pressed lingually into the soft tissue. The same condition is presented with the upper third molar where there is an impaction pressing on the distal surface of the third molar.

When the elevator is applied between the second and third molar there is a liability to push the tooth into the soft tissue. The liability of such an accident occurring may, however, be minimized by excising a part of the buccal osseous structure and straightening the tooth sufficiently with an elevator to allow a good adjustment of narrow-beak forceps, but care should be taken that the beaks do not strike the crown.

(Dr. Simpson had no desire to add to the discussion, and the subject was passed.)

The Individual Normal—The Problem of Orthodontia.

By Dr. A. Le Roy Johnson, Springfield, Mass.

The growth of a science is due to an accumulation of facts. No opinions, beliefs nor convictions, even though advanced by men otherwise highly deserving, can take the place of real and sufficient evidence. At times, science progresses by flashes of intuition, yet more often it is due to the patient and careful unveiling of facts by systematic research. Clinical experience, based upon rather indefinite doctrine, has carried us far enough to put beyond doubt the value and need of orthodontic treatment to many individuals; nevertheless, if orthodontia is to grow and become of practical service to humanity, it will be due to scientific investigations of actual conditions; to research which follows the truth wherever it may lead.

We have been attempting to build a science upon an ideal. An ideal scheme of the occlusal relations of the teeth we have called "normal occlusion." Such a conception as this has been the basis of our diagnosis and treatment; in fact, at the present time, it is finding expression in the endeavor to solve the problem of the correction of malocclusion of the teeth by means of a mathematical formula. However, though the developments of the future should establish the value of mathematical analysis as a step in diagnosis, a conception of the problem of orthodontia as purely a mechanistic one is without scientific justification. It is for the purpose of defining the normal and indicating the way to approach the question of malocclusion of the teeth of the human individual that the considerations of this essay are presented. The subject matter treats of a problem of so fundamental a character that it seems advisable to present briefly the conception of the nature and purpose of orthodontia which has resulted in the seemingly unorthodox point of view.

The Purposes of Orthodontia.

The concept of the normal dental arch is the foundation of modern dentistry. Although the dental arch is often referred to as being composed of the teeth and their supporting structures, a dogmatic definition of it does not convey a true idea of the nature of the conditions which surround all dental operations. The true concept of the dental arch is not limited to a study of the morphological characteristics of the teeth together with their supporting and surrounding structures; it is more comprehensive. It is a concept derived from a study of the action, reaction and interaction of different elements of the dental arch in the continual adjustment of life; it is a concept of the nature of living tissues as they stand in physiological correlation. The structural elements of the teeth; the osseous, nervous, vascular and muscle tissues of the face and jaws intermingle and blend into one another and are controlled in their mutual relations by the more dominant influence of factors involving the entire organism. The line of demarcation between the dental arch and the other tissues of the living organism is not definite. Living tissues blend through an intermingling of structural elements, while the central nervous system and the circulatory system, the avenue of the internal secretions, maintain the fundamental unity of the organism as a whole. The purpose of dentistry is to assist in establishing and maintaining the normal functioning activity of the living dental arch. Hence the ultimate success of dental operations is not determined by their relations to tooth structure alone. All work upon or within the teeth involves living tissues which stand in physiological correlation with other tissues of the living organism.

Orthodontia Defined.

Orthodontia is ordinarily defined as "that science which has for its object the correction of malocclusion of the teeth." But such a definition is of little value because it does not convey an idea of the nature of the problem involved in the correction of malocclusion. We believe it to be nearer the truth to define orthodontia as "that branch of dentistry which treats of the forces controlling the form of the dental arch." This indicates in a general way, at least, the extent of the phenomena to be considered in diagnosis and treatment. The form of an organ or part is the result of an interaction of forces; it is the result of the interaction of function and structure.

Structural form cannot be accounted for by environmental factors alone, nor can heredity explain away all variation. It is the interaction of one with the other, the combined influence of the extrinsic with the intrinsic, which determines the form of structures. Therefore, the subject matter of the science of orthodontia is derived from the two phases of biology, "heredity" and "environment," and is, in the main, a study of the fundamental truths and laws of science as they are expressed in the growth and development of the dental arch of the living human beings and the relation of these truths and laws to specific abnormal structural conditions. Orthodontia is essentially a science of form development.

From such a standpoint as this, the field of orthodontia broadens beyond a study of occlusion. In as much as the teeth are the primary factors in the evolution of the dental arch, and since the principal function for which they exist lies in the physical relations of their crowns, the study of occlusion constitutes a large part of the science. It is, in a degree, an index of the developmental condition of the adjacent structures of the teeth and a register of the forces acting upon them.

Tissues Dealt With In Orthodontia.

Orthodontia is concerned with a collection of structures of different origin, varying in developmental nature, reacting to different influences, yet organized for a common purpose. The occlusal relations of the teeth constitute but one element of a complex of structures interdependent in life, and subordinate in evolution to the organism as a whole. Nowhere in the living organism is there an instance wherein parts of such diverse character are more closely associated or more dependent upon each other than in the dental arch. And it is the purpose of orthodontia to so treat these diverse elements, directly or indirectly, that they will express, individually and collectively, the normal development of the individual organism.

The difference in the developmental nature of the teeth and adjacent structures is a characteristic of the dental arch most significant in the study of malocclusion. Enamel is derived from the ectoderm, while muscle and connective tissue structures are derived from the mesoderm. The dental bulbs appear as shallow inverted cups and beneath their centres is found the condensed connective tissue which gives rise to the body of the tooth, the dentin. The primitive dental bulb is projected directly into the embryonic connective tissue, which underlies and covers the tooth band on all its free surfaces. Ectodermal epithelium pushes into the embryonic connective tissue and the enamel organs thus formed are of such a different nature and are susceptible to such an entirely different set of influences that they mark the slightest variation in the development of the connective-tissue structures. The crowns of the teeth are completely developed in adult form, long before they function in mastication, and in use they wear away, while bone, muscle, vascular and nervous tissues depend for their complete development upon the stimuli of function. This wide difference in the developmental characteristics of the tissues which compose it, makes variations in the form of the dental arch more obvious than in other parts of the organism where the tissues are more nearly of like nature: and for this reason a scientific interpretation of the normal is more essential in orthodontia than in other fields of orthopedia where the structures are, in a greater degree, molded and harmonized by function in the ordinary activities of life. In fact, the fundamental problem in orthodontia is to determine the normal dental arch of the individual organism. It is a problem of the individual as distinguished from class, group or species and as such is inseparably linked with the phenomena of variation.

The Phenomena of Variation.

The most obvious thing about the individual organism is its variability. Variation in form and function is universal among living beings. Although two individuals will resemble each other, possessing certain characters in common, yet invariably, upon close examination, these characters will be found to differ from each other in degree or in proportion. Differences extend to minute particulars and include all characters, function as well as structure, internal organs and parts as well as external proportions. No part of the living being escapes the influence of the "law of variation." Hence an interpretation of the normal as it refers to the dental arch of the individual organism must find a basis in this "law" and must be determined by the methods employed in the analysis of the material relative to it.

The Line of Occlusion.

The question of the normal has been handled as if it were only a problem of species. The attempt has been made to establish an imaginary line, called the "Line of Occlusion," as a criterion by which to determine the existence or non-existence of malocclusion and deformities of the dental arch. Twenty years or more have passed since Dr. Edward H. Angle first defined the line of occlusion, yet for many the question of the normal is still unanswered. In owning that it is so, we do not honor Angle's work the less, for whatever value the future may assign to the line of occlusion in diagnosis, it will always be remembered that it was through the work of Dr. Angle that the problem of malocclusion was first studied as a problem of science. If he did not solve the question of the normal in his early writings, he gave the hope of its solution, undoubtedly a greater thing.

The endeavor to utilize the line of occlusion as a standard by which to determine the normal involves a contradiction. As has already been emphasized, orthodontia is concerned with the dental arch of the individual organism while the line of occlusion is based upon a consideration of type. The contradiction lies in the assumption of an individual type.

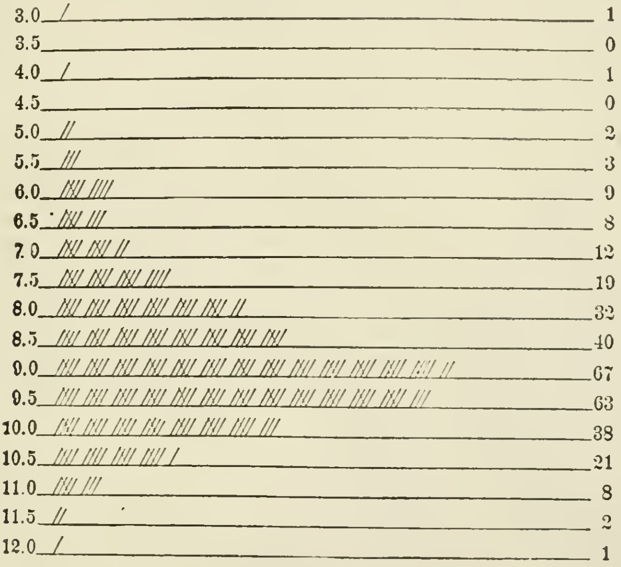
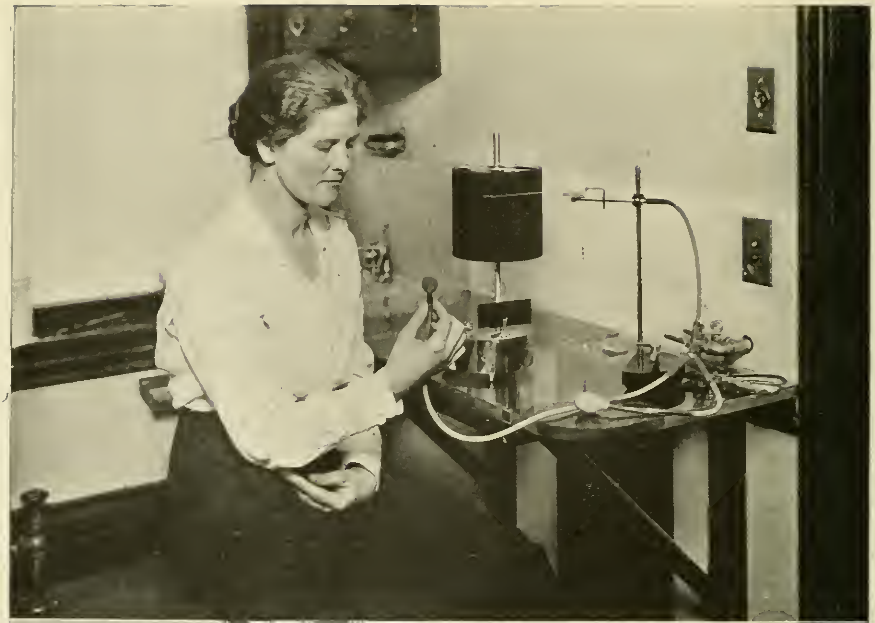


Fig. 1.

Consideration of Type.

"Type" is a word that has been used very loosely, but literally interpreted, it refers to a general form or plan of structure common to a number of individuals. It is the ideal representation of, or the most perfect exemplification of, a natural group. It is a composite of individual forms. An individual is not referred to as a class nor is an individual a type; in either case the individual is but a unit in the composition of a class or type.

I quote from Davenport a concrete case which will best illustrate the principle involved. "A random sample of Leaming corn, consisting of 327 ears, gave the distribution as to length as illustrated in Fig. 1. It will be noted at once that there are more ears of nine inches than of



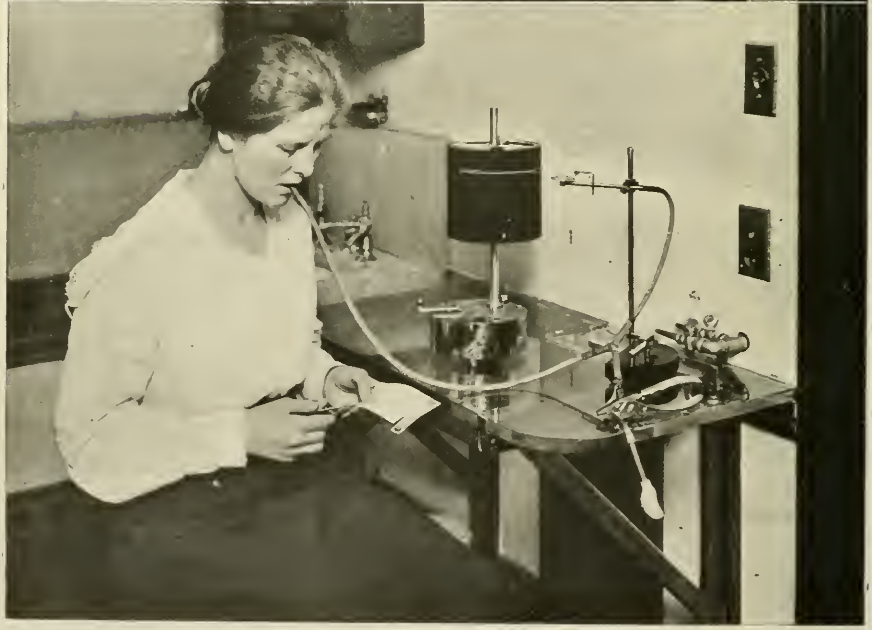


Fig. 2. Fig. 3.

any other length, and that the distribution decreases in both directions, but unequally, from this highest frequency. This highest frequency, or most common length, shows clearly what is the prevailing type as to length in the crop, and it is held by statisticians to be the best obtainable expression for type. When it is ascertained, therefore, we know at once what is the natural type of the race or variety, so far as the character in question is concerned, and when this is determined for a number of important characters we shall have a good knowledge of the racial type as a whole. But in obtaining the mode of another character as circumference or weight, the ears tabulated as typical will not necessarily be the same as those which constitute the group of highest frequency in a study of length. Consequently, while we might obtain the mode of the circumference, number of rows, weight of ear, or any other desired character, and having done so are able to describe definitely a typical ear, it should be clear that the typical is not a concrete thing, existing in natural form, but is of the nature of an abstraction, a model or pattern from which the individual presents some degree of variation. The word "type" used with individual, refers to certain marked racial characteristics which the individual possesses. It directs attention to certain traits or features which are common to different individuals. It cannot in any sense apply to the individual as a specific standard of normality. For there is a great range of individual variation without departure from type.

Furthermore, the concept of the line of occlusion embodies the idea of the teleologists who believed that normal organs and parts express the most perfect means of performing the function for which they exist. This theory has long since been abandoned. Huxley says that teleology, as commonly understood, received its death blow at Darwin's hands. Darwin simply affirmed that organs and parts work well enough to enable an animal to survive, but admitted the possibility of improvement in their form and function. And his opinion holds true today.

Therefore, in the face of constant variation and incompleteness, it is evident that the normal as it applies to the individual organism cannot be determined by a study of type taken of itself alone, or of structural perfection. If the typical is utilized as a definite standard of normality of the individual and all variations from it classified as abnormal, then the normal individual does not exist. It is not reasonable to base our diagnosis upon a concept which can never be realized in natural forms.

The scheme of occlusion expressed in the ideal relations of the inclined planes of the cusps of the teeth is a working hypothesis; it is

Fig. 4.

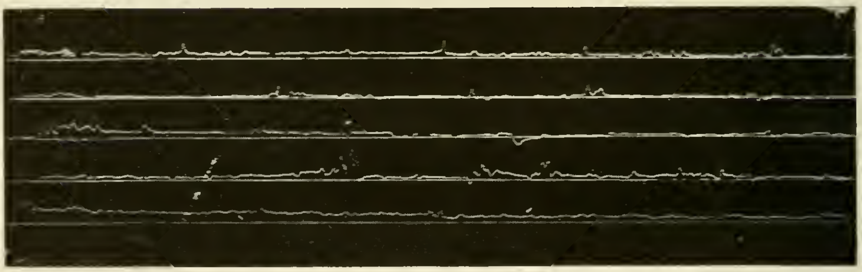


Fig. 5.

Fig. 6.

a theory to be adopted as a guide in an investigation of the real nature of occlusion. A hypothesis is not proved; it is assumed to account for a fact or an occurrence. If you were to determine the ingredients of a chemical compound, a general knowledge of its kind or character would decide the methods to be employed, and each succeeding process would be the result of an assumption or theory that such procedure would reveal one or more of the constituent elements of the compound In other words, in chemical analysis a theory which has a basis in fact, is the assumption, the belief, the hypothesis, which leads to the investigation that reveals the real nature of the phenomena in question. A hypothesis leads to facts; it does not express actual conditions al

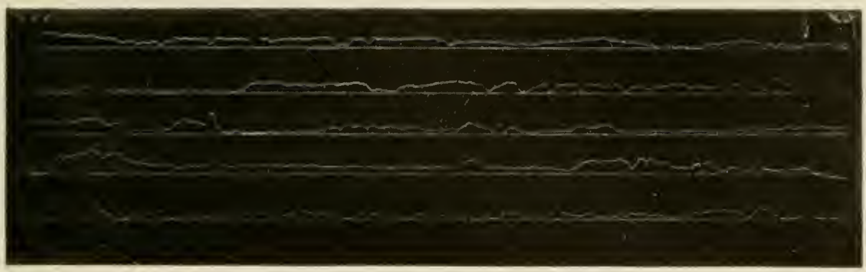


Fig. 9.

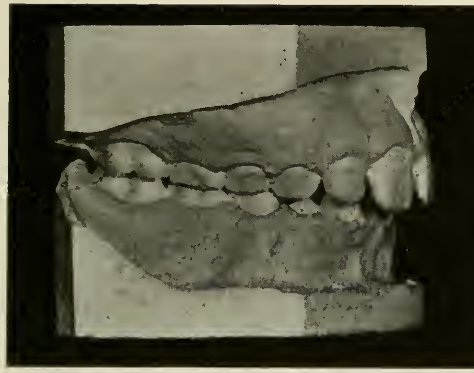


Fig. 7.

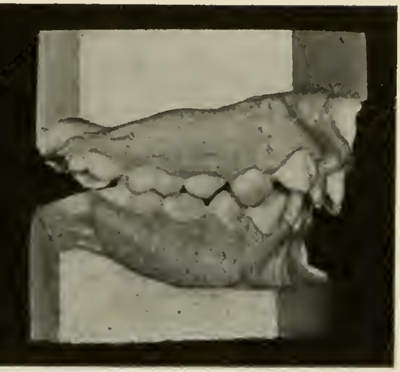


Fig. 8.

ready established. The ideal scheme of occlusal relations commonly called normal occlusion is a concept derived from a study of the law of occlusion, and is the mental picture, the working hypothesis, essential in an investigation of the nature of occlusion, as it is in the mouths of men today. Such a concept furnishes the groundwork for a study of the facts, the real evidence which constitutes so vital a part of the subject matter of orthodontia.

Normal Defined.

The word "normal" means a resultant of correlated factors. As it is used in orthodontia, it refers to either one of two classes of phenomena; either to the general form of a character as seen in a group of individuals or to a complex of the individual organism. The former signifies a correlation expressing the typical form of an organ or part as seen in many individuals; the latter signifies a correlation which is best suited to the life activities of the individual organism as a whole. Hence, in the study of occlusion, then, we are concerned with two groups of phenomena, the "species normal" and the "individual normal."

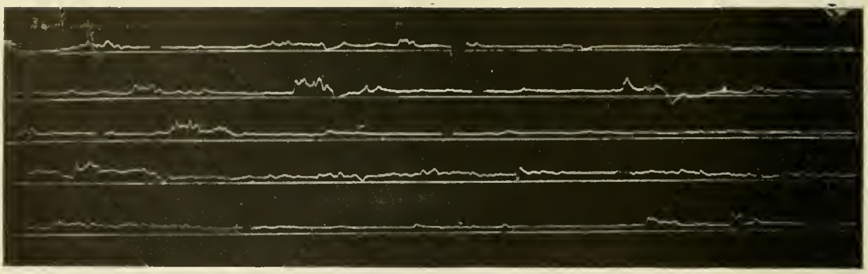
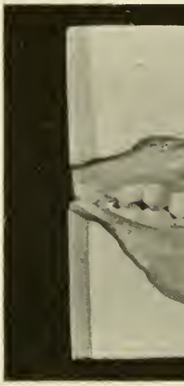


Fig. 11.



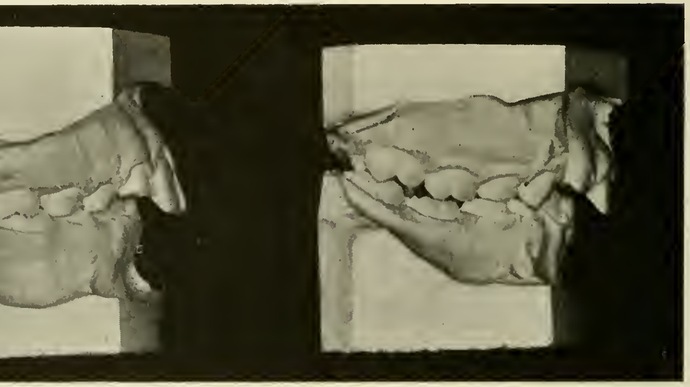


Fig. 10. Fig. 12.

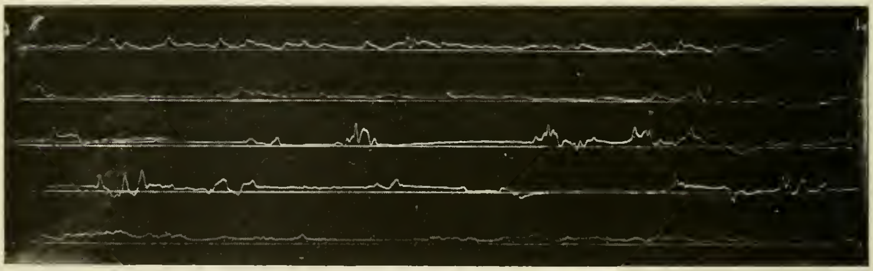


Fig. 13.

The Species Normal.

The species normal is a concept derived from the observation and comparison of the occlusal relations of the teeth of many organisms. It is the result of combining, of bringing together in one concept a variety of structural conditions, each different from the other, no two alike, as illustrated in the study of the typical ear of corn. The species normal might be considered as a composite of the occlusal

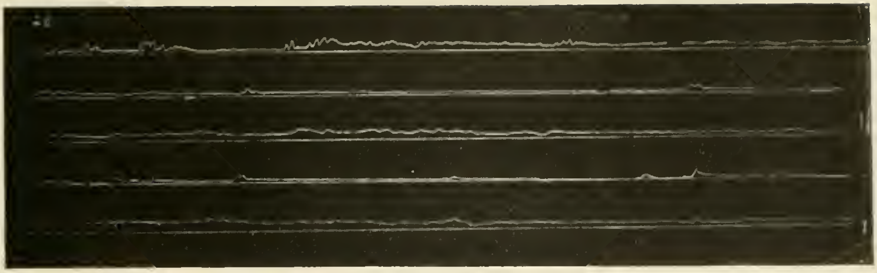


Fig. 15.

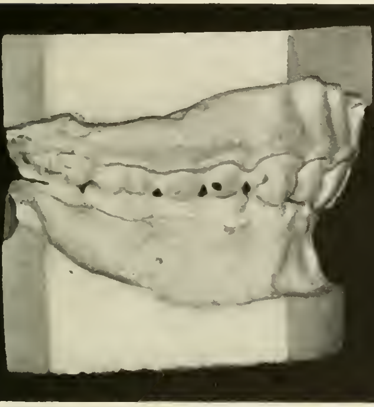


Fig. 14.

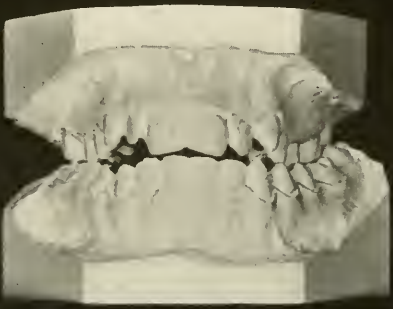


Fig. 16.

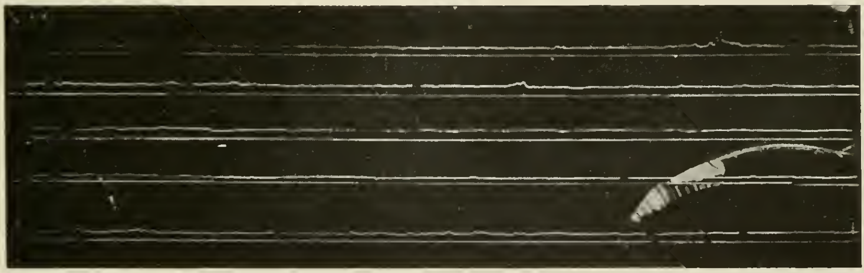


Fig. 17.

relations of the teeth of many organisms. If it were possible to make a composite photograph of the occlusal relations of the teeth of a group of individuals from all angles the result would portray the typical occlusion, the species normal.

The word "normal" in the phrase "species normal" refers to the resultant of a correlation of structural conditions. In much the same sense, R. E. Lloyd, in his work on *"The Growth of Groups in the Ani-*

FIG. 19.

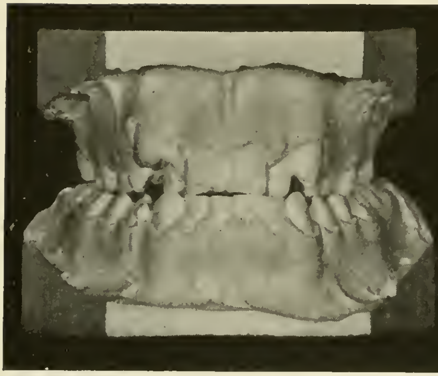


FIG. 18.

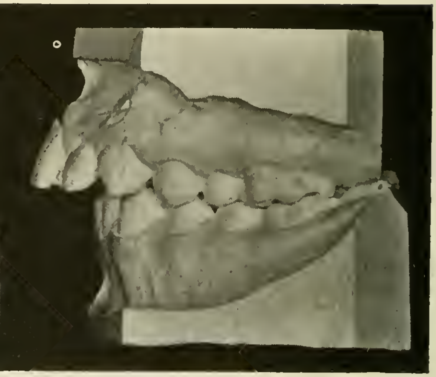


FIG. 20.

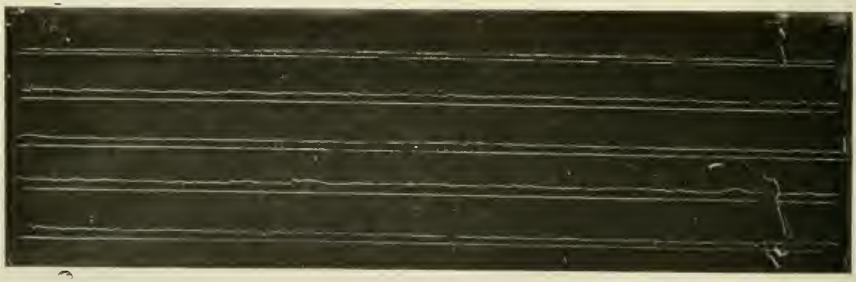


FIG. 21.

mal Kingdom," uses the word "normal" as the majority. The word "species" is chosen for its literal sense. Although it is often used to designate an aggregate of individuals, varying around a normal type, such is not the strict interpretation of the word. Many species that were once thought to be distinct from one another have later been united by the discovery of intermediate forms. Perhaps the most notable instance illustrating the arbitrary character of the grouping of the species, is where two animals which were at one time classed as belong-

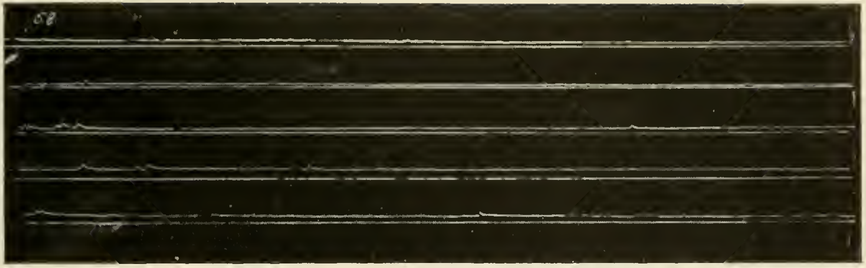
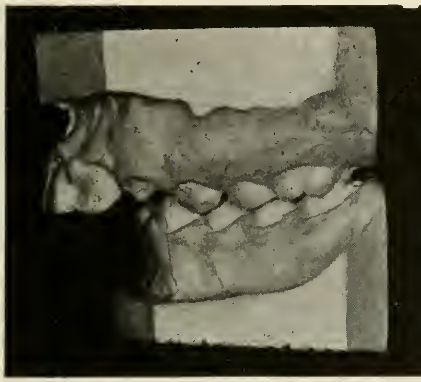


Fig. 23.



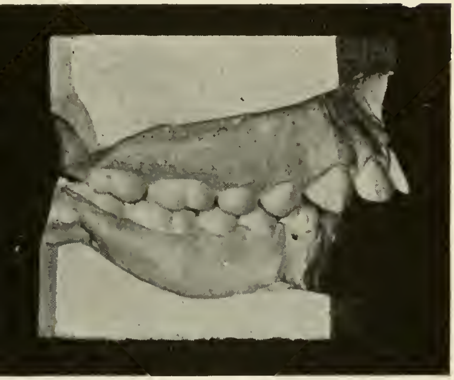


Fig. 22. Fig. 24.

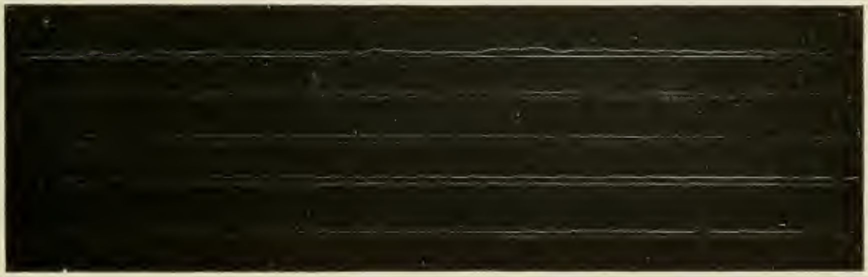


Fig. 25.

ing to different species were later proven to be male and female of the same. Of course, it is true that at a given time, the forms of living things may be arranged in specific groups, and between the immense majority of these there are at the present time no transitional forms. However, we know from the law of variation that even the characters which determine the grouping together of certain individuals are not identical but vary in some degree, in some way, from each other. And it is with these variations that we are concerned in

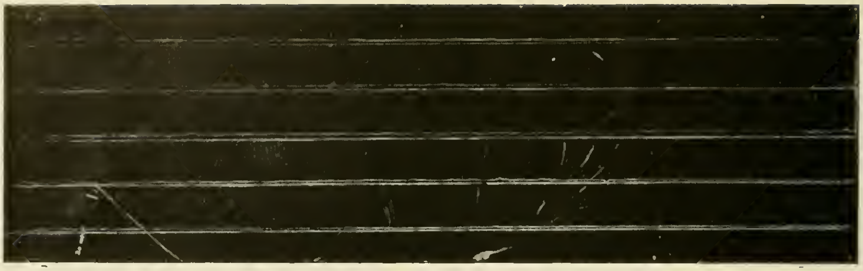


Fig. 27.

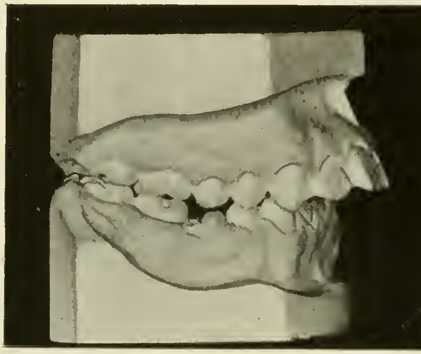


Fig. 26.

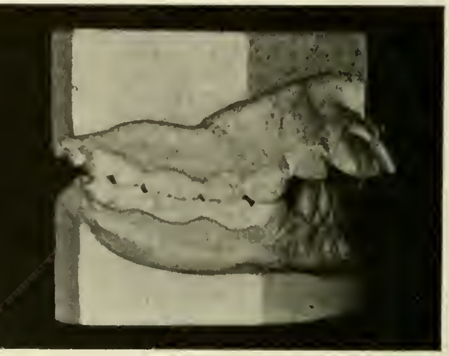


Fig. 28.

Fig. 29.

orthodontia. In its most literal translation, "species" means an abstract form, an abstract condition of occlusion, if you will, around which a group of variations oscillate. It is in this sense that it is used in the phrase "species normal." It seems better to convey the idea of the typical in this way than to employ the "collective normal" of the psychologist. Species, although used synonymously with typical, seems preferable, as it contrasts more clearly with individual.

The Individual Normal.

The "individual normal" is the result of the correlated activity of many parts of the individual organism. It is the result of a complex of physiological processes. The individual normal refers to the form of occlusion best adapted to the needs of the organism as a whole. It refers to the condition of occlusal relations which is the most effective in maintaining in its most stable form the equilibrium expressed in the life phenomena of the individual organism. It may or may not approximate the species normal. It is not an artificial creation built upon an ideal plan. It is the most perfect condition of occlusion that the nature of the tissues and the functional activities of the organism as a whole will permit.

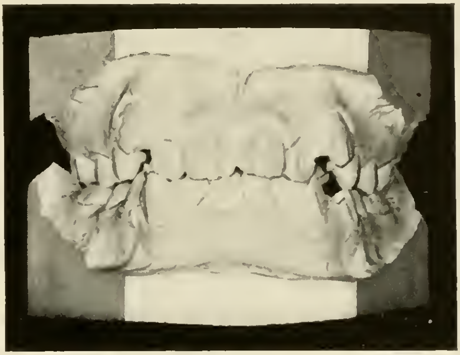


FIG. 30.

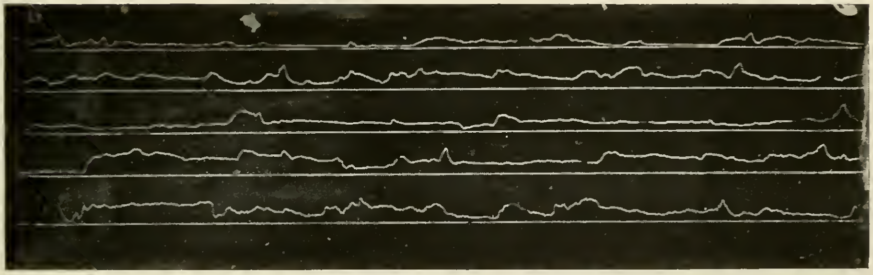


FIG. 31.

The dental arch is a mobile equilibrium reflecting the inheritance and life activities of the individual organism as a whole. To know when the form of a dental arch is normal for a particular individual is a difficult problem, and its solution, which is so vital to orthodontia, involves a consideration of the fundamental principles and laws of science. There is no short cut to a solution of the problem of deformities of the dental arch.

A science in its growth passes successively through the speculative, the qualitative, the quantitative, to the predictive stages of development.

As a result of speculation, qualitative work is done and from the general principles thus established, quantitative methods can be evolved which in a varying degree will make prediction possible. Much qualitative work is necessary in orthodontia before it can lay claim to quantitative methods of procedure. A statistical study to ascertain the typical occlusion, the "species normal" of man, is yet to be done. Although a most perfect occlusal relation may have been born into the race, we do not know enough of the true nature of occlusion as it is today. Of course, such an investigation would be a difficult and tedious task. In fact, it is futile to suppose a very fine degree of accuracy in recording observations of this nature. Yet research of this kind is one of the first essentials in establishing orthodontia in science. General principles derived from studies of groups and species are indispensable in a study of the individual organism. They are indices to individual characters.

Study of Tongue Movements.

Much of the evidence in the following illustrations is still obscure. The studies of it have not been carried far enough to establish its full value. Yet certain tendencies are sufficiently clear to justify a preliminary report. No further claim is made than that the evidence in its present form points to a correlation of a physiological nature and indicates one of many ways to approach the question of the individual normal. The study is of involuntary tongue movements.

The apparatus used is patterned after that of E. W. Scripture in his work on "*Stuttering and Lisping.*" It consists of a kymograph and tambour which is connected by rubber tubing with a very delicate rubber bulb. See Fig. 2. The bulb is inflated by forcing air through the auxiliary tube. When this is done, the recording needle is raised as shown on the drum. With the patient holding the tube in the hand, a base line is recorded upon the smoked paper. Then the end of the tube is held firmly between the incisor teeth, placing the bulb between the tongue and the hard palate. The patient is told to allow the tongue to rest against the bulb, and the following tests are made, each one being preceded by marking the base line and all are of one minute duration. First, subject sitting still looking out of window; second, reading to himself; third, cutting figure out of paper as seen in Figure 3; fourth, writing verse of song with pencil upon black of paper; fifth, repetition of first. Approximately two hundred charts have been made. Figures 4, 5 and 6 will give an idea of the variations met with. From the anatomical structure of the tongue and its involuntary character, an irregular line might well be anticipated. But the difference in the character of the lines and the relation of this difference to the structure of the dental arch is at least significant. The charts were classified according to their general character, without consideration of sex and with very little regard to age. Of course, the class distinctions were not absolute, there being transitional records in all instances. However, certain things were evident. The majority of the charts of patients with the overbite form of malocclusion were in the same class. They were characterized by an irregular tongue line which dropped to and often below the base line. While this was not seen in all of the cases that, from a study of occlusion alone, would be classed as overbite cases, it has not as yet occurred where other forms of malocclusion were present.

Figure 7 same case as 5.	Figure 10 same case as 11.
Figure 8 same case as 9.	Figure 12 same case as 13.

Figure 13 same case as 15.

The latter is particularly interesting in its similarity to the others from the fact that the patient is from six to eight years older than the others.

The open-bite cases and those with the relatively short overbite show the tongue line well above the base line.

Figure 16 same case as 17.	Figure 20 same case as 21.
Figure 18 same case as 19.	Figure 22 same case as 23.

The cases illustrated in Figures 20 and 22 have responded to treatment without difficulty, while Figures 8 and 10 are quite different. The teeth move easily but there is a constant tendency to relapse.

Figure 24 same case as 25.	Figure 28 same case as 29.
Figure 26 same case as 27.	Figure 30 same case as 31.

Note rhythm in the tongue line of Figures 24, 26, 28 and 30. In each of the first three cases the incisors would push forward unless appliances were worn intermittently. It will be obvious to many that the absence of a gauge to register the pressure of air in the rubber bulb admits an element of error in the records. This is, of course, also true of the condition of the rubber on the tambour and bulb. But recognizing all this, the fact is that the rhythm evident in these three charts was not seen in any of the others. What further study will reveal I cannot say. Figure 30 is still under treatment.

Figure 31—Chart of a boy with chorea manifest in the superficial muscles around the orbits.

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Discussion of Dr. Q. LeRoy Johnson's Paper.

Dr. John V. Mershon,
Philadelphia, Pa.

After reading Dr. Johnson's paper many times, I feel that it is a mistake to discuss it. I consider it so nearly a perfect presentation of facts, that to add to it would be impossible, so my remarks should not be considered a discussion. I am only going to call your attention to some facts and emphasize what seem to me to be very important.

The whole trend of Dr. Johnson's paper is to show that we have been undertaking to work to an ideal which does not exist; that is our past conception of the ideal normal occlusion, and he has given us the correct standard to which we can work, and a basis on which to start to study. In the study of the individual normal, normal must be measured by the functional activities of the forces of development. Dr. Johnson has very properly called our attention to the fact that the orthodontist can no longer depend on the morphological characteristics of the teeth, and their supporting and surrounding tissues; but that we are dealing with a portion of the human being, and that the mouth and all the organs which compose the oral cavity are just as much parts of the human being as the lungs, the liver or any of the other organs, and are affected by the internal and external conditions both in growth and development, so that we must treat the individual as a whole.

Dr. Johnson's definition of orthodontia is a great improvement over anything we have had previously. He defines it as that department of dentistry which treats of the forces controlling the form of the dental arch. Later on in the paper Dr. Johnson, in referring to normal variations, states that these variations are not confined to the osseous tissues in which the teeth are located. We have the same variation in the form and size of the teeth, as nearly all tissue form depends on function. Yet the teeth are formed before they begin to perform the function for which they were originally designed. These facts would seem to prove conclusively the fallacy of undertaking to predetermine the size and shape of the dental arch solely by measuring the tooth material, and entirely disregarding the forces which operate through function to produce form.

Dr. Johnson has also shown us that arch form is of the individual normal. It would be interesting in studying Dr. Johnson's illustrations, if we could have an analysis of the individuals from which these records were made, as to what deformities may exist in the other parts of the body. The story told by these illustrations seems to be very closely related to the work done by Dr. Johnson and Dr. Hatfield on muscle development. In their investigations they showed the relationship between the lower muscle tone and bad osseous development. These records which Dr. Johnson has been showing is another connecting link between a certain type of osseous deformity represented by a certain type of malocclusion which expresses itself indirectly through the nervous system by the way of the involuntary muscle fibres in the tongue which are responsible for the variations shown on the records. In both of these investigations it appears to be shown that malocclusion is only a local expression of a general constitutional condition. The result of these investigations should further impress us with the fact that orthodontic appliances are not the only prescription necessary in the treatment of malocclusion. A great deal more importance should be attached to the value of these investigations than Dr. Johnson seems willing to admit. I think this society should be congratulated that we have men who are willing to spend the time and energy necessary to make these investigations and give them to us absolutely free, as Dr. Johnson has done this year and last year.

Dr. William C. Fisher, New York City. I find very little left for me to say after the paper of Dr. Johnson and the discussion by Dr. Mershon.

In one place the essayist says: "If the typical is utilized as a definite standard of normality of the individual, and all variations from it are classified as abnormal, then the normal individual does not exist." That is the meat of that particular part of his paper. Typical and normal do not *mean* the same thing; they cannot *mean* the same thing and they cannot *be* the same thing; but, unfortunately, many have frequently confused them into meaning the same thing.

Dr. Johnson spoke of the influence of heredity. How many of us, when we have our little patients come in, make concrete models and immediately base our diagnosis on them, outline the appliance to be used, have it made, and put it on the patient? And that is as far as we have gone in our diagnosis. How many of us look into the antecedents of the child, and how many of us think of what the normal for that child should be? Nine times out of ten even the most conscientious of us have unconsciously in our mind's eye the so-called normal arch type, and we do not consider the child. This leads to the point I would like to emphasize, viz.: "How will this affect our work?" That is what we want to get out of the papers presented here. What difference will they make in our treatment of cases? To me this communication has a very important bearing on the treatment of malocclusions of the deciduous teeth.

I was asked this question in this meeting recently: "What would be your treatment of a child between five and six years of age where there is pronounced malocclusion?" My answer is that in the majority of cases I would recommend that the child be kept out of the hands of the orthodontist. I do not believe that we are warranted in interfering with many of the deciduous malformations, for the reasons brought out in Dr. Johnson's paper—study the individual normal. We cannot possibly tell exactly, nor know in what direction a child will develop, what the normal of that child can be at so tender an age as four or five years. When you see babies at the first and second years, the parents and the relatives of the baby will tell you and admit to you that the child is a living image of the mother. By the time that child reaches five or six years of age it is so absolutely changed in its appearance that it may resemble the father and have no resemblance whatever to the mother. As time goes on and the child develops it may lose its resemblance to either one of the parents and may take on a resemblance to the grandparents. Changes occur in the families where you study the physiognomy of the children. With that point in mind, how can we determine the treatment of these deciduous cases? In my own practice I have for a long time confined orthodontic interference in malocclusion of the deciduous teeth to the expansion of the mandibular cuspid region, and that only rarely. To know the individual normal is to know your science. In other words, it cannot be laid down by rule and compass, but can be realized only by years of experience.

Dr. B. E. Lischer,
St. Louis, Mo.

I hesitate to discuss this very interesting paper extemporaneously because it is a philosophical dissertation on fundamental problems.

Dr. Johnson made the statement in the first paragraph of his paper that if orthodontia is to be of practical service to humanity, we will have to study this subject. I would like to insert the word *more*. The fact that we are here today is proof that we have been of *some* value to humanity. That, however, is a minor criticism.

He has called our attention to the factor of *variation.* The study of variation, as I understand it, has led to the conception that *variations* are of *germinal origin;* they are *congenital.* But there is another subject in connection with this matter that requires our attention, namely: *modifications.* These are wrought in an individual's lifetime, are *somatogenic,* or *acquired.* Many modifications can be found in the facial features; I refer particularly to those due to the anomalies of dentition. And while I would not detract one iota from the imperious hypothesis of occlusion, I want to call your attention to the fact that we will shortly have to study in greater detail the facial modifications of our patients.

For several years I have taken life size photographs of the face of every patient that has come to my office, and I find these are of great value to me. I have reference particularly to the facial features that are involved in the orthodontic treatment, and I have been amazed at the many variations and modifications that we are confronted with. I am convinced that many of our preconceived theories will have to be exploded.

But as I have previously said, I am not prepared to discuss this paper as I should like to, and I want to thank Dr. Johnson for its very able presentation. It seems to me that it opens up tremendous possibilities.

Dr. Milo Hellman,
New York City.

I will discuss Dr. Johnson's paper because it merits discussion. In doing so, however, I shall touch upon one point in order to bring out in a concrete form a suggestion Dr. Johnson has passed by so lightly. And that is the remarks made relative to the mathematical calculations employed as predetermining factors for the various dental arch forms.

If you will permit me to show one or two diagrams which I have used in connection with a paper read before the Alumni Society of the Dewey School of Orthodontia, I shall be able to bring forward some comparative evidence bearing upon this topic.

If the contention be correct that the dimensions of the teeth will predetermine the form of the dental arch in man, the evidence obtained from comparative studies would verify it. With this end in view, I examined a number of anthropoid apes, comprising all the genera included in the family. These are the gibbon, the orang, the gorilla and the chimpanzee. The skulls of the apes examined belong to the collections of the United States National Museum of Washington, D. C., and the American Museum of Natural History of New York. While the teeth of the anthropoids themselves bear a close resemblance in form to those

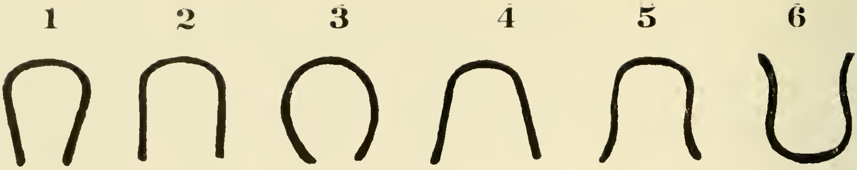


Fig. 1.
Illustrating diagramatically the various forms of the dental arches of the anthropoid apes.

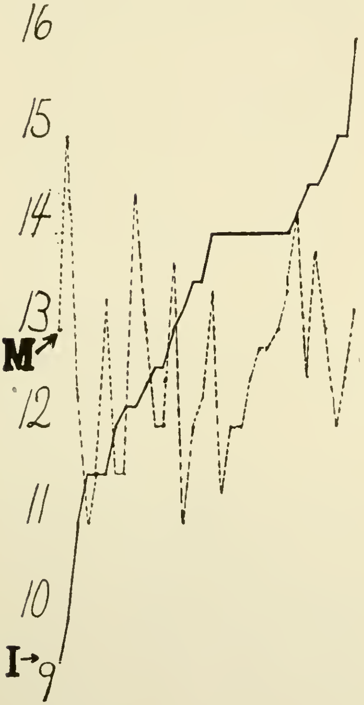


Fig. 2

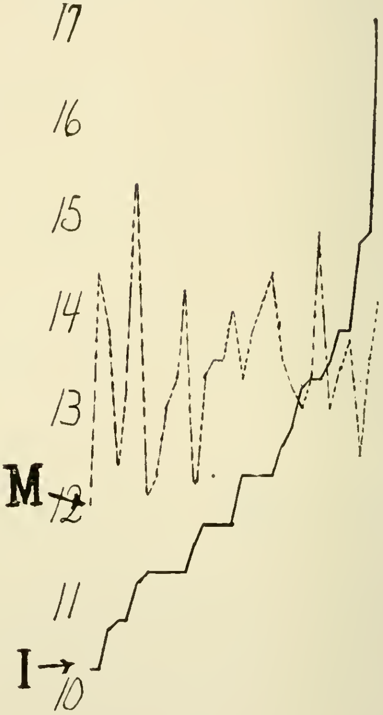


Fig. 3.

Fig. 2.
Illustrating the relationship of the mesio distal diameter of the upper central incisor and the upper first molar of each individual possessing the same arch form. I indicates the incisor curve, and M the molar curve, showing no correlation whatever between these dimensions. Numbers indicate dimensons of the teeth in millimeters.

Fig. 3.
Illustrating the labio-lingual dimensions of the same teeth as in Fig. 2 and the manner of their relationship, worked out in the same manner.

of man, with the exception of the canines and lower first pre-molars, the arch-forms differ considerably. However, in form the dental arches may be classified under six main types. These are: The pear-shaped, the inverted U-shape, the divergent shape, the oval shape, the saddle shape, and the lyre shape. (See Fig. 1.) Each dental arch in the anthropoid series must fall under one of these forms. But there are generic differences in the prevalence of arch form and the frequency of their appearance in each group. Thus, the gibbon presents the arch forms under 2, 3, 4, 5, 6; the orang, under 1, 2, 3, 4, 5; the gorilla, under 1, 2, 3, 5; the chimpanzee, under 1, 2, 3, 5, 6. Moreover, each genus exhibits a preference for a certain type of arch form. In the gibbon, the upper arch form most frequently noted is the lyriform, appearing in 75 per cent. of cases. In the orang, the lyriform appears in 38.5 per cent.; in the gorilla, the U-shaped form appears in 46.1 per cent., and in the chimpanzee the lyriform appears in 40 per cent. of cases.

If there is any relationship between the size of the teeth and the form of the arch we should find similar-sized teeth in a particularly shaped arch. That is to say, if we take the 75 per cent. of cases in the gibbon that fall into the lyriform arch, the central incisor of each of these cases should be of uniform size, or taking the combined dimensions of all, they should have at least a higher average than the central incisors of the cases belonging to the combined other forms. This should be evident if there is any definite correlation. But actually I did not find it so. On measuring all central incisors belonging to the lyriform arch they were found to vary, and, averaging their dimensions, it was also found that there was no difference in the *average* for the central incisors belonging to *one particular arch form,* for *the combined forms of all the arches showed a similar average.* The same test was made upon all the anthropoids and the conclusion reached is that the average dimension of the incisors belonging to one arch form is no higher than the average of the central incisors belonging to the different arch forms.

It was then of interest to find out whether there is a correlation between the two dimensions of one tooth in a particular arch form; that is, is there a correlation between the mesio-distal diameter and the labio-lingual diameter of the same tooth in the same arch form? There was found to be none. Is there a correlation between the mesio-distal diameter of two teeth in the same form of arch? That is, is the mesio-distal diameter of the central incisor and the mesio-distal diameter of the first molar of the same dental arch in correlation?

Fig. 2 illustrates a diagram which conveys the answer.

Take, for instance, the pear-shaped arch of the orang, the mesio-distal diameter of the central incisor varies in that one arch form in different individuals between nine and sixteen millimeters. That is all right. It has a right to vary. But if there be a correlation between the dimensions of this tooth and those of any other tooth, the dimensions of the other tooth should vary accordingly. So on arranging the dimensions of the incisors varying between nine and sixteen millimeters according to size, the ascending curve in Fig. 2, I, was obtained. But on charting the molars belonging to each individual whose incisors are thus marked, as indicated by the vertical lines, the irregular curve, as may be seen in Fig. 2, M, was obtained. While there is a gradual rise in the mesio-distal dimension of the incisor, the sizes of the same molars of the same individuals fluctuate up and down, showing that there is absolutely no relation between the two. A similar arrangement of the labio-lingual dimensions of the same teeth, as may be seen in Fig. 3, produced no different results. This test was made on every arch form of the various genera, the result not changing at all. These records undoubtedly show the sort of correlation existing between dimensions of the teeth and of the form of the arch, thus having a concrete bearing upon that point referred to by the essayist.

With relation to the charts of Dr. Johnson, he suggested that we should not pay any attention to them. To my mind they are very indicative, and I do not hesitate to say so.

I have been intensely interested in the study of the etiology of malocclusions for the last five or six years, have made many studies and have charted a good many cases to find something of value. I have published several papers on the subject, and the last contribution I made was based on the general disturbances of the individual in their relation to malocclusion. In the various studies I have found that there is a considerable correlation between the malocclusion of the teeth and malnutrition of the individual in early infancy. Also subsequent disease processes due, not only to artificial feeding, but also to various conditions associated with disturbances that bring about artificial feeding, are found to be correlated with occlusal anomalies. I would, therefore, be very much interested to know whether Dr. Johnson has made any examinations into the past history of the cases of malocclusion from which he has obtained these charts, because I feel that in some cases, like children who have suffered from exudative diathesis, there are certain defects left which they probably never overcome. These defects would give expression in some sort of curve which may be indicative of some particular disturbance or disturbances in infancy.

Dr. W. H. Gilpatric, Boston, Mass.

I did not intend to bring up the subject that I am about to refer to, but inasmuch as Dr. Hellman and Dr. Johnson led up to the predetermination of the dental arch to a certain extent, I will discuss it.

Dr. Hellman spoke of apes. We as orthodontists are not today dealing with apes. He also spoke in regard to measuring one central incisor and predetermining the arch from it. I do not think that can be done.

In the past two years and a half I have been working on the predetermination of the dental arch and, as I understand and construe Dr. Johnson's paper, the individual normal arch. Nature has given us certain tooth substance; we have not selected this tooth substance for the individual case, and a patient comes to us with an abnormal supply of tooth material: what are we to do?

If you have eighty-five millimeters of tooth substance in the case of Johnny Jones, and eighty-five in the case of Billy Smith, does it not stand to reason that you are dealing absolutely with the same tooth substance in each arch? That you are going to have but slight variation from the contact points which you need to get in order to have the same shaped arch?

If you have ninety millimeters of arch tooth substance to deal with from the buccal groove of the first molar to its opposite, you can vary that arch very little and still have normality, and if you have eighty-five millimeters you naturally would have a different shaped arch from one where you have ninety millimeters.

What are men doing with the cases that come to them? What basis have they for the predetermination of the arch? Nothing but the eye at the present time. Dr. Johnson is working along the right line, but there are a dozen different roads leading to the same point. I am glad Dr. Johnson and several other men are making investigations.

In my own work I worked very nearly a year, then I endeavored to prove whether the work was correct. I began looking for the normal in the human mouth. I have, at the present time, about fifty cases, and I can predetermine those arches for a given tooth substance. The greatest variation I have is one millimeter, and that is caused by the loss of the lower first molar on one side.

I would like to make an appeal to the members here to get at these normal cases to check up my work and look for the normal for a given amount of tooth substance to see what nature has done. In cases that I have treated where I have established good relation between the tooth substance and the width of the molars, these have been the easiest and most successful in retention.

As I said before, I did not intend to speak on this subject, but I have been working along this line for a considerable time. It is an evolution from the work of Dr. Hawley, Dr. Williams and Dr. Stanton, and I have what I call the orthodontographic normal arch for a given proportion of tooth substance.

I have also developed a simple machine for surveying the malformed arch, and I wish to take this opportunity to present arches and the machine to you. I will give you the drawings, you can have them made, and if you wish to have that part of the arches copyrighted, so that you can have control of them. They are yours.

If my work is any help to you men, you are welcome to it.

You can take it, pick it to pieces, or combine it with other ideas ot other men. If there is anything in it that is good, save it and do not throw it away.

Dr. Frederick C. Kemple, New York City.

A few years ago, in company with Dr. Clarence J. Grieves, at the Baugh Institute of Anatomy in Philadelphia, I had the privilege of examining a rather large number of wet sections of the heads of children varying from infancy to adult life. These specimens were made by Dr. Warren E. Davis for the purpose of studying the development of the accessory sinuses.

Dr. Grieves and I were interested in finding out whether there was any correlation between the development of the dental arch and the development of the nasal spaces and accessory sinuses. We were also interested in learning what change in the anatomical structure of the base of the skull might be induced by widening the upper dental arch that could possibly result in relieving pressure upon the pituitary body. The specimens examined, and there were quite a large number, apparently showed no definite relation whatever in the development of the dental arch, and the development of the nasal spaces and the accessory sinuses. Neither could either of us see how the widening of the upper dental arch could bring about a lowering of the body of the sphenoid bone, or in any other way relieve pressure upon the pituitary body. The anatomist in charge of the institute pooh-poohed the idea of this latter being possible.

Before examining these specimens, and others in Dr. M. H. Cryer's collection, I had a preconceived notion that there might be a definite relationship existing between these parts; that they develop more or less symmetrically; that well-developed sinuses and nasal spaces accompany well-developed dental arches, and vice versa. But in my limited investigation I have found no evidence to support this theory. In fact, just the opposite condition is found to exist so frequently that I am led to believe there may be no interdependence in the development of these parts. I am afraid that many of the idealistic theories in orthodontia will vanish into thin air under the searchlight of real scientific investigation.

It is a well known fact in physiology that "hard structures must give way to the soft." In other words, slight pressure of any of the soft tissues upon any of the osseous tissues causes a giving way of the osseous tissue, either by resorption of the bone itself or by a change of its form. The records that Dr. Johnson is making of the nervous muscular action of the tongue are along this same line.

I am glad to have heard Dr. Johnson's paper, and to have seen the charts shown by Dr. Hellman. It is all very illuminating, and promises a brighter future for orthodontia. If a few more men will join in an effort to get at the truth, to uncover facts in orthodontia, it will not be many years before our specialty will rest on a scientific foundation, instead of being built upon the sand of beautiful theories.

Dr. Hellman. Dr. Johnson, you have shown one case where the upper incisors were persistently drifting forward after retention. Did you observe whether that child or person was lisping?

Dr. Johnson. No, sir. We could not find any difficulty anywhere, and I would not have been led to this extreme if I had.

Dr. B. Weinberger. I hesitate to discuss Dr. Johnson's paper because it would be unfair, for one cannot do it justice without first thoroughly studying it. It proves one thing, however, that the general tendency of orthodontia in the last few years has changed and is progressing more along the physiologic than the mechanical side. We must pay attention to the correlated facts between the various organs outside of the mouth, and that brings us back to the point of the nervous system. This brings up the question of calcium metabolism, which has a direct bearing on tooth development and jaw growth. I do not know whether Dr. Johnson is familiar with the work of the neurologists. These men are paying a great deal of attention to the endocrine organs and their relation to the teeth and tooth substance, and to the construction and form of the teeth, and what direct bearing they have on the various nervous disturbances with which they have to deal. How much stress and how they are paying attention to the teeth and their form in trying to solve the various questions of thyroidism, pituitarism, and so on through the various cycles, may be seen from recent literature. I think, as orthodontists, we have been very lax and in the future will have to pay more attention and open our eyes to the work that these men are doing. As orthodontists, we will have to recognize the knowledge that these men possess and the attention they have paid to the teeth and the bearing they have on calcium metabolism and on nervous disturbances with which they have to constantly deal. One of the main factors to be considered, and one of the first things they observe, is the blood pressure.

I want to ask Dr. Johnson whether he has taken into consideration blood pressure in charting these cases, because it is more than a nervous tendency for the tongue to raise the tip; and also indirectly to the endocrine organs, which have a prenatal origin.

Dr. Johnson. I am very grateful to the men who have discussed my paper. It is very gratifying that Dr. Hellman should present the evidence he has at this time, as he was wholly in ignorance as to what my paper was to be. We have evidently arrived at the same conclusions though following different lines of study.

Dr. Lischer misunderstood the reading of my paper. Variation I did not consider as of germinal origin exclusively. It may be of germinal original or it may be of environmental origin. The form of an organ or part is the result of an interaction of forces. Two stones of different character exposed to the same environmental forces will take on different forms; and two stones of the same character exposed to different extraneous forces will show different conditions. The determining factor of form may be either heredity or environment. When we refer to the formative influence of function, the word function is used in its broadest sense and not as referring to the specific activity of an organ or part. Function expresses all of the dynamic processes of the living organism; the complex of chemical reactions; the action, reaction and interaction of organs and parts in the adjustment of life

Dr. Lischer. Do you recognize modification?

Dr. Johnson. Yes.

Dr. Lischer. As distinct from variation?

Dr. Johnson. The word "variation" covers the modification of form.

A Member. What do you mean by modification?

Dr. Lischer. Something that happens in the individual's lifetime.

Dr. Johnson. The enlargement of a muscle as a result of exercise is modification; it is also variation. Variation may be qualitative as in mutations, illustrated in the work of Morgan on the drosophilia; or it may be quantitative as in the development of a muscle.

A System of Keeping Orthodontic Records.

By C. W. B. Wheeler, New York City.

For a number of years I have been extremely interested in the matter of orthodontic records, and the problem of getting these records with as little inconvenience and loss of time to the operator as possible.

This will necessarily be a short paper, as it deals with the description of a system of keeping records, which in itself, should be as compact and easily handled as possible to make it efficient, and for this reason, needs very little explanation.

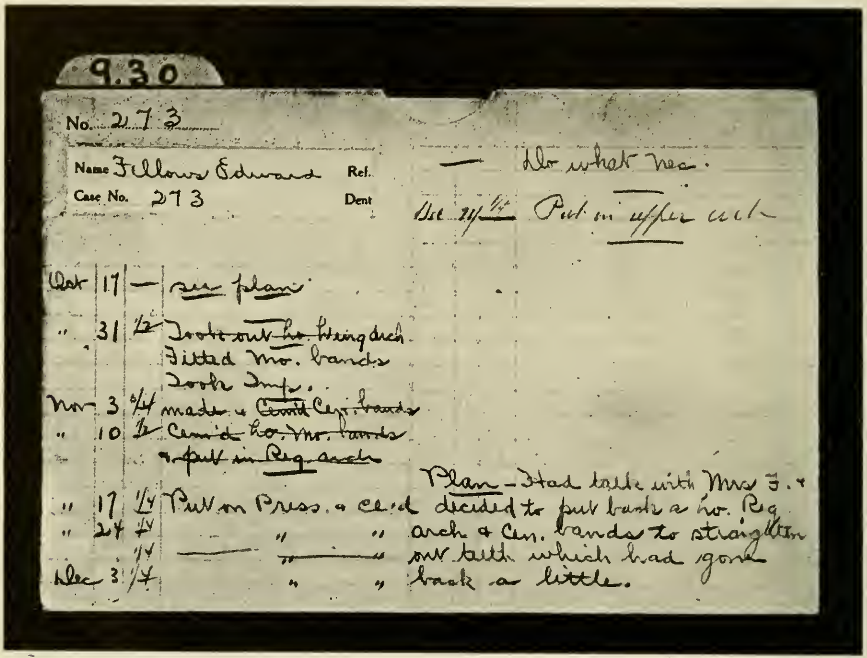
Dr. Lischer's excellent paper which was read before this society at Pittsburgh in 1916, I believe was an inspiration to all of us, and he pointed out why records should be kept both for our benefit and that of others. He went over the reasons why every one should feel himself deeply obligated to keep such records, but this paper deals only with my own methods, which may or may not be already used by some of you in whole or in part.

I trust it will bring out a discussion that will still further simplify the matter, because I believe it is the thought of the immense amount of work involved that keeps many from having a most valuable record file.

I will first describe envelopes, records and time index cards, then our methods of using them for notes, records and as an appointment file.

Envelopes.

The envelopes that we use are four by six inches, so that any file this size will accommodate them, and an opening is cut in the upper left hand corner that allows the name of the patient and the case number on the card or cards enclosed to show through. The space above the opening is left for the case number, and as this number is the same as the one showing through the opening no mistake can be made.



9.30

No. 273

Name Fellows Edward Ref.

Case No. 273 Dent

— Do what nec.

Dec 11 1/4 Put on upper arch

Oct 17 — see plan

" 31 1/2 Took out ~~lo.~~ Ling. arch

Fitted Mo. bands

Took Imp.

Nov 3 3/4 made & ~~Cem'd~~ Cen. bands

" 10 1/2 Cem'd lo. Mo. bands

& put in Reg. arch

" 17 1/4 Put on Press. & Cen'd

" 24 1/4 " "

1/4 " "

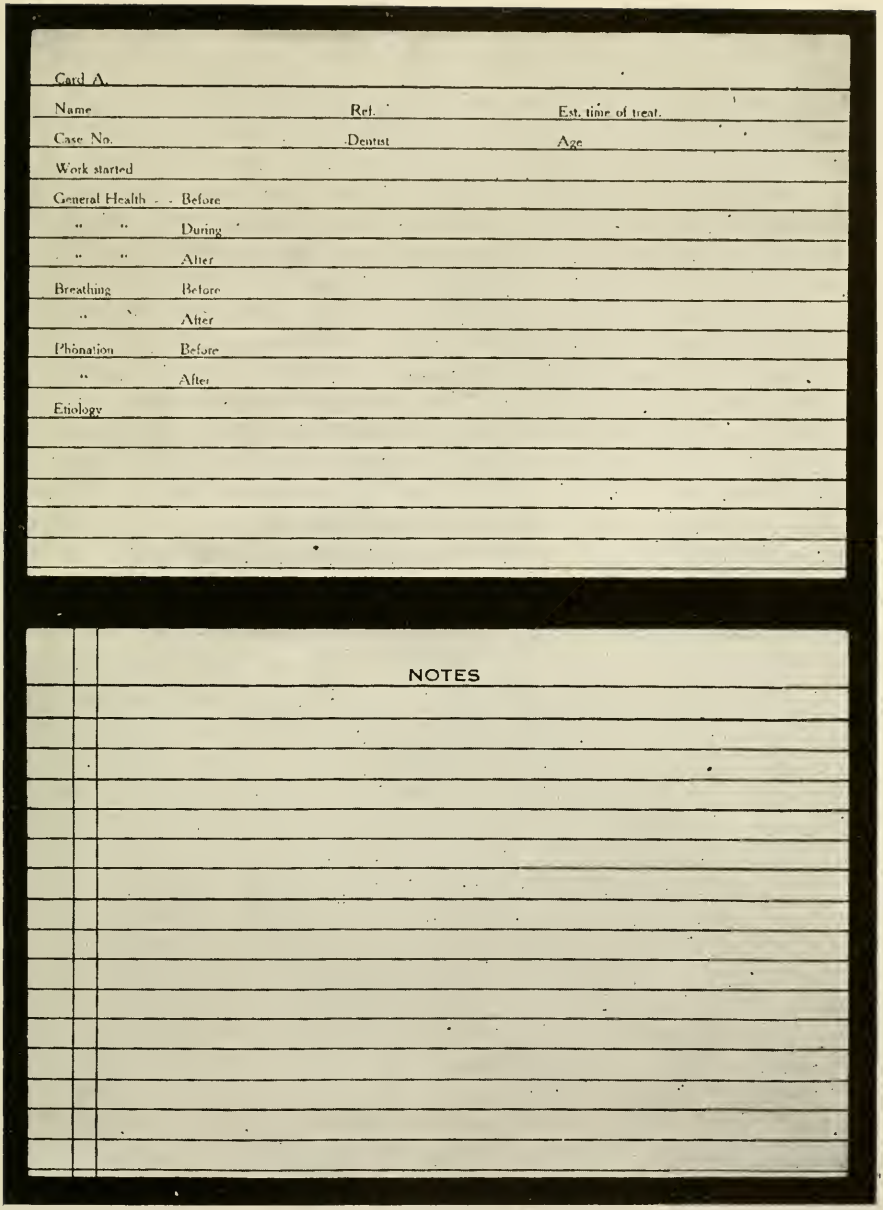
Dec 3 1/4 " "

Plan — Had talk with Mrs F. & decided to put back a lo. Reg. arch & Cen. bands to straighten out teeth which had gone back a little.

Envelope with record enclosed.

They are made of light weight inexpensive paper, and are used only for keeping the record cards, photographs, plans, radiographs, etc., together, and for making such notes or plans as are to be kept temporarily and later transferred to Card A or B. When the front has been completely filled with notes, it may be thrown away and a new one substituted. The front is ruled in the regular way with columns for the appointment dates, as well as another to show the time consumed while the patient is in the chair.

Card A. These are the regulation four by six-inch cards with from one-eighth to one-quarter of an inch taken off the length before printing, so that they will fit easily into the envelope. On the front of the card is given a place for the name and the case number in the upper left hand corner, so



Card A.

Name Ref. Est. time of treat.

Case No. Dentist Age

Work started

General Health - - Before

" " During

" " After

Breathing Before

" After

Phonation Before

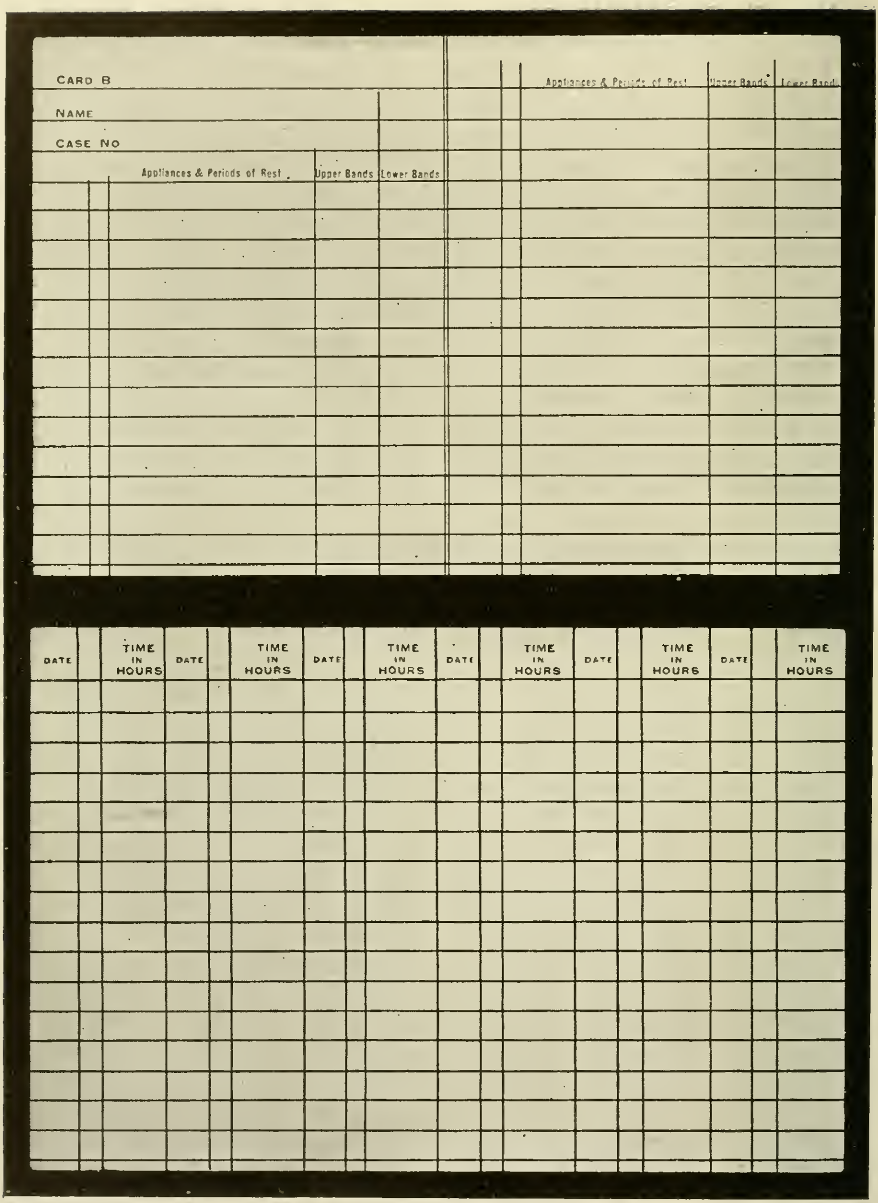
" After

Etiology

NOTES

Card A. Front and back.

that it will show through the opening of the envelope. There are spaces arranged for references, estimated time of treatment, age, when the work was started, general health, before, during and after treatment; breathing



CARD B

NAME

CASE NO

		Appliances & Periods of Rest	Upper Bands	Lower Bands			Appliances & Periods of Rest	Upper Bands	Lower Bands

DATE		TIME IN HOURS	DATE		TIME IN HOURS	DATE		TIME IN HOURS	DATE		TIME IN HOURS	DATE		TIME IN HOURS	DATE		TIME IN HOURS

Card B. Front and back.

before and after; phonation, before and after; and the etiology. A place for classification was not made on these cards, which was an error of the printer. It is readily written on each and on the next lot will, of course, be taken care of. The back of this card is used for notes and is ruled for this purpose.

Card B.

On the front of this card is given places for the name and the case number, also for noting when the impressions are taken, appliances put in or taken out, and the particular kinds of appliances or retainers that are used. There are also columns to show what teeth are banded. On the back of this card columns have been ruled leaving spaces for appointments made during the treatment, time consumed at the chair, or lost by broken appointments.

Time Index Cards.

This is the regulation blank index card, four by six inches, which, of course, is trimmed to fit the envelope, and on the tab which protrudes when the card is placed inside is marked the different hours. If the first morning appointment is never before nine, we should start with this hour marked on the first tab; then on the next 9:15; next 9:30; next 9:45, 10:00, etc., and so on throughout the hours of the day until the time for closing. A number of these sets should be kept on hand. There should also be a number of index cards of a different color, with different intervals of time marked on them, such as fifteen minutes, thirty minutes, forty-five minutes, one hour, etc. The use of these cards will be explained under the description of the appointment file.

To use these cards and envelopes as we do, it is also necessary to have a small box or file conveniently placed on either the cabinet by the side of a chair, or near there, that will hold about twenty of the envelopes. Also a regular file alphabetically arranged in another part of the office convenient for your secretary to get at.

Methods of Keeping Records.

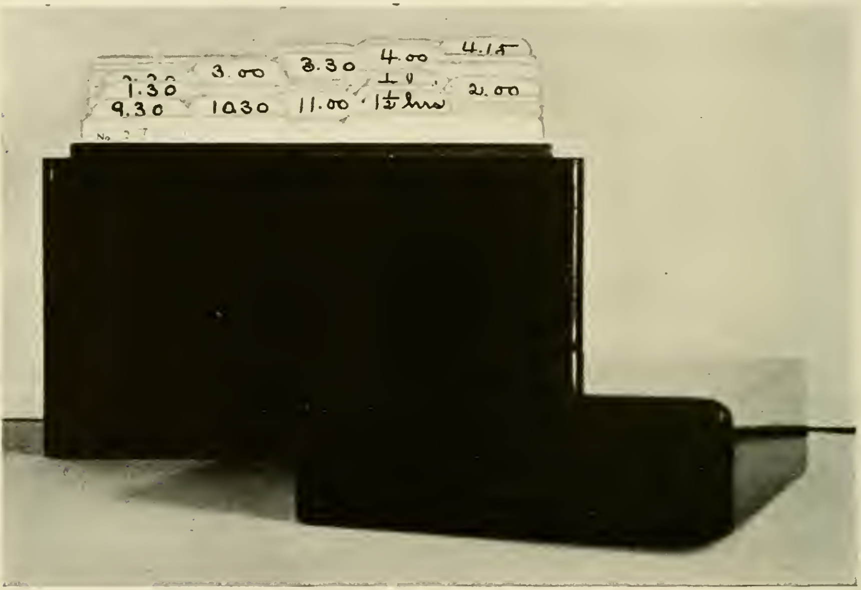
When a new patient starts work he is given a case number, and this with his name is placed on Cards A and B, the case number being also placed on the envelope.

Card A is filled out with such data as is obtainable at his time.

The envelope with cards enclosed is then placed in the regular file under the first letter of the patient's name.

Before I arrive at the office in the morning, or late in the afternoon of the day before, the secretary consults the appointment book and takes from the file the envelopes of such patients as are to be waited on that day or the next, at the same time slipping in a time index card into the envelope so that the tag protrudes showing the hour of the patient's appointment.

Should there be an interval of time during the day not taken, an index card bearing figures denoting the extent of the period, such as one hour, one and a half hours, or whatever it may be, is picked out and placed between the envelopes of the patients where such a period occurs.



Filing box.

This takes little, if any more time, than writing out a list of the patients for the day with intervals of leisure.

The bunch of cards are then put into the small box or file at the side of the chair, and at a glance you can see just when the next appointment takes place, the extent of time allowed for same, when any interval free from appointments will occur during the day, and this without leaving the chair to go and look over the appointment book.

Should it be the first appointment for work, and the first patient of the day, you will find his envelope in front and the tab or the index card will show when he is due.

If, at this sitting, impressions are taken, bands fitted, a plan laid out, or any other operation performed, an abbreviated note is made with pencil on the front of the envelope with the date. Just below it a note can be made of what you intend to do at the next sitting. This sometimes brings back quite quickly to the mind at the next visit just what was planned at the last. If this is not done when a large number of patients are coming in, quite a little time may be lost during the day.

It takes but a moment to make these notes, and when the envelope is handed to the secretary just before she makes the appointment, she knows something about what is to be done and can arrange the time accordingly. Then when she has the leisure, work that has actually been accomplished is noted on Card A with the date. On Card B is placed the interval of time consumed. The record is then complete and is placed in the regular file.

The plan of having the entire history of the case at hand so that it is always before me when patients are in the chair is a great help in many ways, and if one acquires the habit of jotting down just what is done at the time when it takes place it soon ceases to be a burden. With the time consumed the appliances and retainers used noted on the card, it is very easy to check up your mistakes and the inefficiency of appliances or retainers used in the correction of the different classes of malocclusion.

At the end of the treatment, the time consumed at the chair, may be found in a few minutes, and this with the number of appliances used will give a definite idea of what our fee should have been in the treatment of such a case.

If an index is kept for any length of time, it will show the average time consumed in correcting the malocclusion occurring in the different classes and giving a solid foundation for estimating the amount of our future fees for such a condition.

To sum up: The main features that I have found a help to me in this system are:

1. The compactness of data in each case.
2. Of having it before me every time the patient is in the chair.
3. Knowing at a glance at any hour of the day just what work is before me.
4. Being able to jot down when it is fresh in my mind with no loss of time.
5. To know what appliances have been used during treatment.
6. And know the time consumed during the treatment of a case.

Symposium on the Advisability Versus the Inadvisability of Maintaining Spaces in the Mouths of Children, Where Teeth Are Missing, for the Purpose of Later Inserting Artificial Substitutes.

By Burt Abell, D. W. Flint and J. Lowe Young.

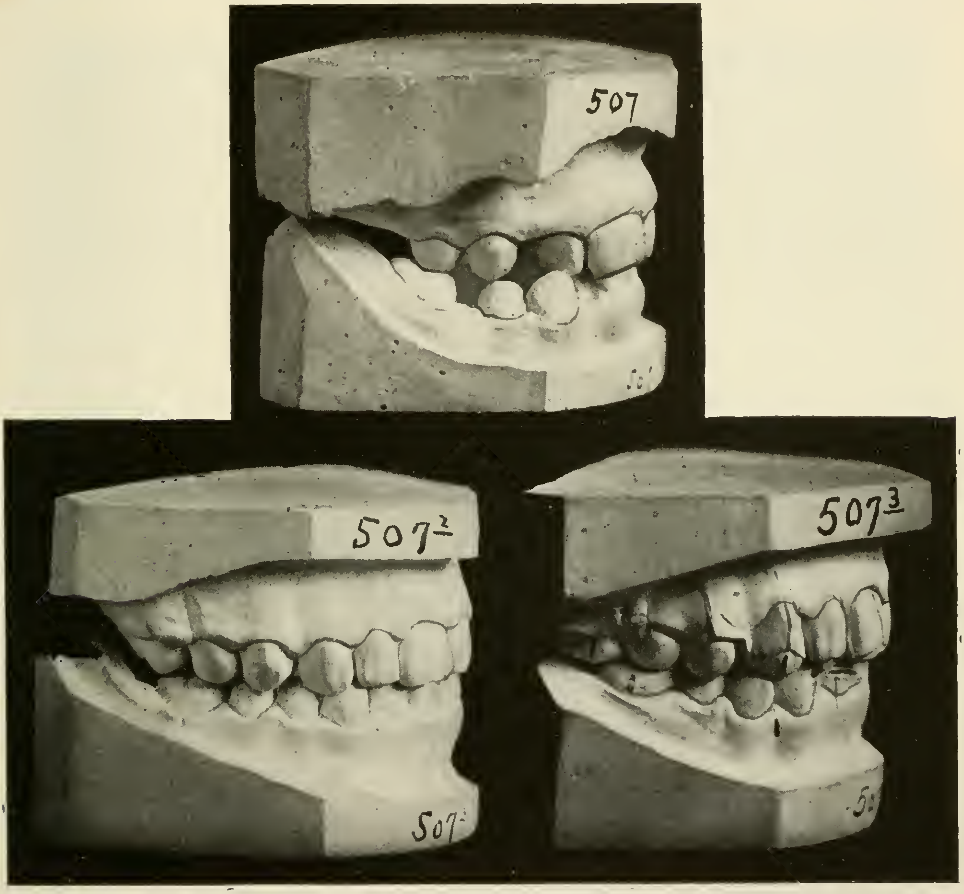
Dr. Burt Abell, Pittsburgh. When Dr. Kemple asked me to take part in this symposium, I was inclined to refuse, because I felt that I had had no experience that was different from that of others, but after he explained that we should make it a report of cases, I told him I would do the best I could.

I am here to help out in this discussion. I will tell you what I do and what I purpose to do, and if you will tell me what you would do, I will be grateful to you.

There is no problem in my practice so hard to manage as cases where there are absent or missing teeth.

Model 507 (Fig. 1) is a case that came to me a year or so ago. The first upper permanent molar on the right side was missing—extracted, and an attempt had been made to move the second permanent molar forward to take its place. This is pertinent to the subject, because wherever this can be done it is an advantage to do so. 507³ is later than 507² (See Figs. 2 and 3). When I discovered the molar was taking an excursion, I took a wax impression and made a study model of the case. The question I would ask is, is it possible to make that upper second molar take the place of the first permanent molar which is absent (it appears to be making the attempt to resume its old position) (Figs. 2 and 3), and make it stay there? I think it is a crime to put in an artificial tooth if we can possibly avoid it, in children.

In case 683, (Fig. 4) there is a lateral missing. This is a temporary lateral. Nature has tried to do the proper thing by moving all the upper teeth forward, and I am going to leave this arrangement of teeth as near as I can and make the mesio-buccal cusp of the molar take the place of the second bicuspid and use the cuspids as laterals rather than put in artificial substitutes of any kind. There is a supernumerary (Fig. 3) which does not enter into consideration of this case and it was extracted. Notice the temporary lateral. Is there any better treatment than I have outlined?



Figs. 1, 2, and 3 (Abell).

Case 735 (Fig. 6) is a case which proves that we need to make extensive radiographic examinations. This upper second bicuspid came into place and adjustment was made of the molars and the other teeth. I obtained fairly normal occlusion with the lower temporary tooth in position. I waited and waited for that temporary tooth to be discarded,

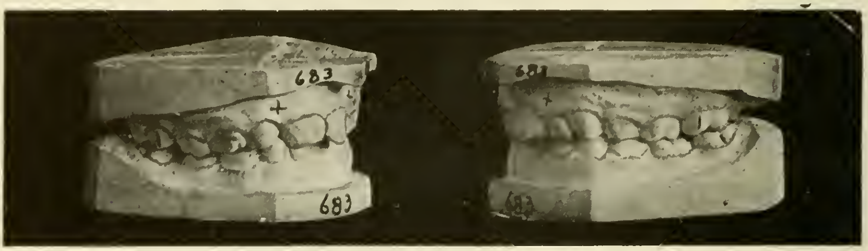


Fig. 4 (Abell)

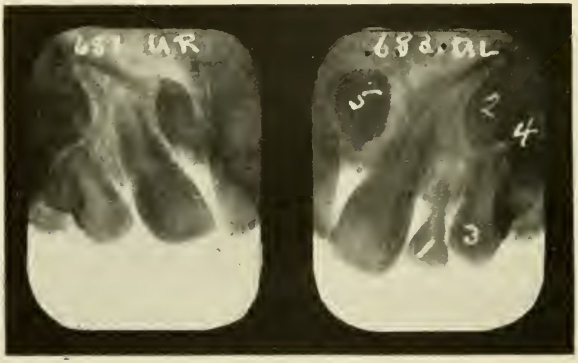


Fig. 5 (Abell).

but I finally became alarmed about it, and the radiograph (Fig. 7) shows what I found. (See 735 X-ray). Please remember the good condition of the temporary tooth at first. If I had known the permanent tooth was missing I could have saved the temporary tooth by exercising some care. I could have retained it for a long time. This is my report to you with the S. O. S. call.

Dr. W. D. Flint, Pittsburgh

Did you ever hear the expression, "I never thought of that?" It just so happened years ago, that one day J. Lowe Young was visiting my office when I was about to treat a case in the usual way, where the lower left first molar had been prematurely lost, with the characteristic conditions, apparent protrusion in the upper arch, retraction in the lower anterior region, with a forward, downward, inward tipping of the second molar.

He suggested that I bring the second molar forward, which I did with very gratifying results. The third molar erupted at the age of sixteen and took its place in good shape.

Well, this was the first breaking away from dogmatic teaching, and I suppose I have been falling from grace more or less ever since.

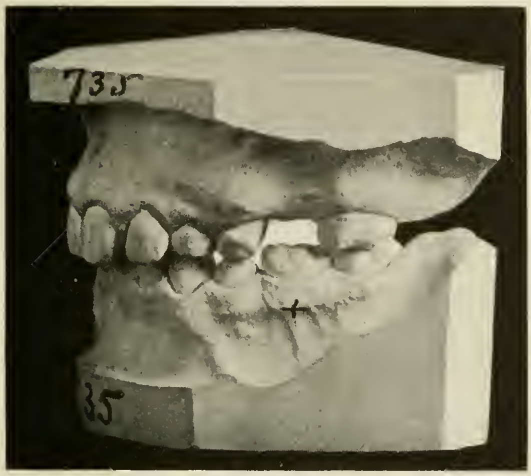


Fig. 6 (Abell).

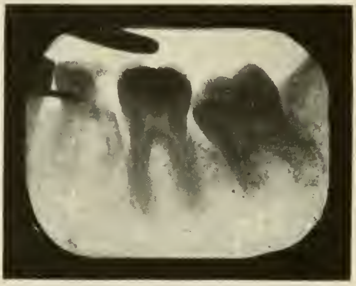


Fig. 7 (Abell).

I might say here that on several occasions I have endeavored to bring the tooth back of the space forward and have failed, and then I had to resort to pushing the same back preparatory to insertion of a bridge. This is my practice, first to try and close the spaces, and if the osseous conditions are such that I cannot do so, then I resort to our first teaching; this, of course, applying to the loss of the first permanent year molar.

When a lower lateral or central is congenitally absent I have practiced both ways, but you will find considerable sense among our patients and to hear testimony from their own lips, they would rather have a slight rotation of some of the upper incisors, owing to the extra amount of tooth substance, than to be inflicted with bridgework or artificial substitutes in any form all their days; and I heartily agree with them. I would not now open up a space in the lower incisor region.

It is a calamity when a patient is handicapped by the failure of nature to give the allotted number of teeth, but they will live through it, even if we are very much perplexed as to our plan of procedure. The fact is, our work is difficult when we have mutilations in any form, and here is where we need all the knowledge we can command.

I want to report on one case, a boy, eleven years of age. A lower first bicuspid had made its appearance, but remained stationary for six months, when upon radiographic examination it was found to be infected with a large area at the apex. This tooth was taken out and in five months his second bicuspid and both molars were brought forward perfectly. This, to my way of thinking, was a really worth while operation, and it opens a field, a new field, in this day, when we are hearing so much and are having such bad reports of infected teeth.

Lateral incisors are quite often missing. I am in that condition myself, but I would rather be shy than have the best artificial substitutes that I know anything about. I know of one case where the spaces were opened for a mature man and substitutes supplied, and the facial appearance was simply awful.

For girls, in the anterior part of the mouth I will say that I have not been disappointed in a single case when I have opened up the space and replaced with a dummy. I have one lateral being carried by a very stiff iridio-platinum band, and in twelve years the same has not even become uncemented. This same case the dentist refuses to take off as in his judgment it is a much better piece of bridgework than he could offer, the color, the shape of the tooth and all, being so satisfactory, and yet it was placed only as a temporary piece of work.

I doubt if a rigid rule can be laid down for any one's guidance in the matter of when and when not to open up spaces. We must use common sense and all the light we can get to govern ourselves.

Treatment of Cases Having Teeth Missing and Lost.

By J. Lowe Young, D.D.S., New York.

We cannot put too much emphasis on the fact that the best results from an orthodontic standpoint cannot be obtained unless the full complement of teeth are present. This topic deals with cases where teeth have been lost or are congenitally absent. It has been my good fortune to have had but few cases of children mutilated by the exodontist, but many cases have been treated where teeth were congenitally absent. Many adult cases have been treated that were mutilated.

In this article, "missing teeth" refers to those which are congenitally

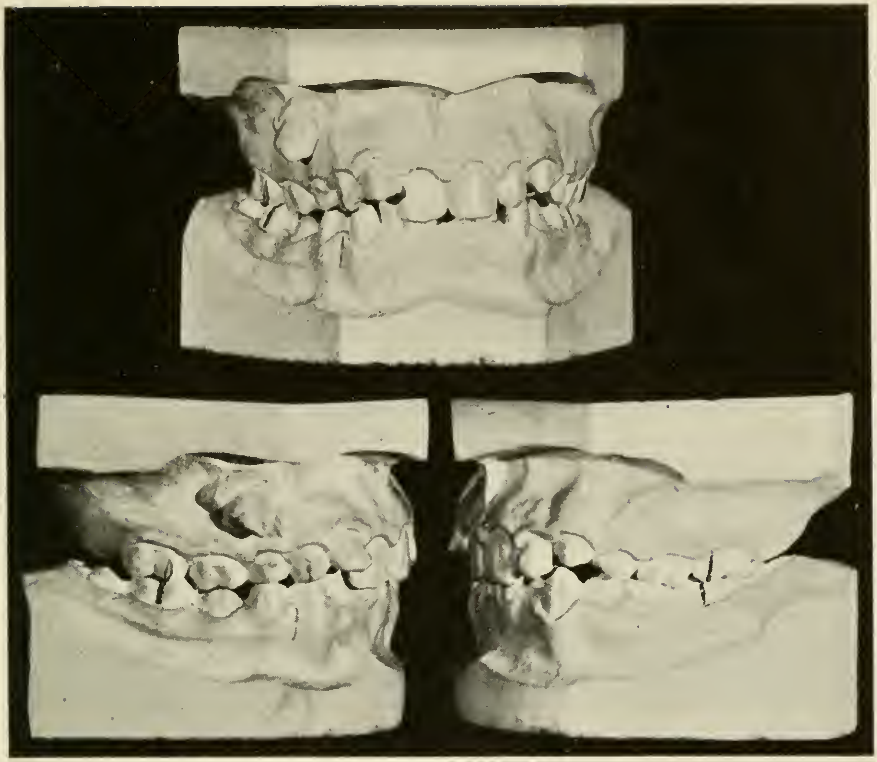


FIG. 1

Shows cast of a girl of 12 with the right upper cuspid over the deciduous molars. Some years previous this child had an infected antrum and the surgeon who opened into it from the mouth removed the developing premolars and caused the death of the pulp of the cuspid. The X-ray substantiated this history.

absent and "lost teeth," to those which have been extracted. This subject may, therefore, be divided into three parts: First, those under fifteen years of age with teeth missing; second, those under fifteen years of age with teeth lost; and third, those over fifteen years of age with teeth missing or lost. It used to be thought that the upper lateral inciscors were the most liable to be missing from the permanent set, but careful observation has proven this to be erroneous. My records show the lower second premolar missing more often than any other tooth from the permanent set. The number of teeth found missing ranges from one to many. The greatest number of missing teeth I have encountered is seventeen.

In the treatment of mixed dentures it is advisable to have radiographs of all deciduous teeth areas to determine whether their permanent successors are present. When the radiograph shows that not more than four

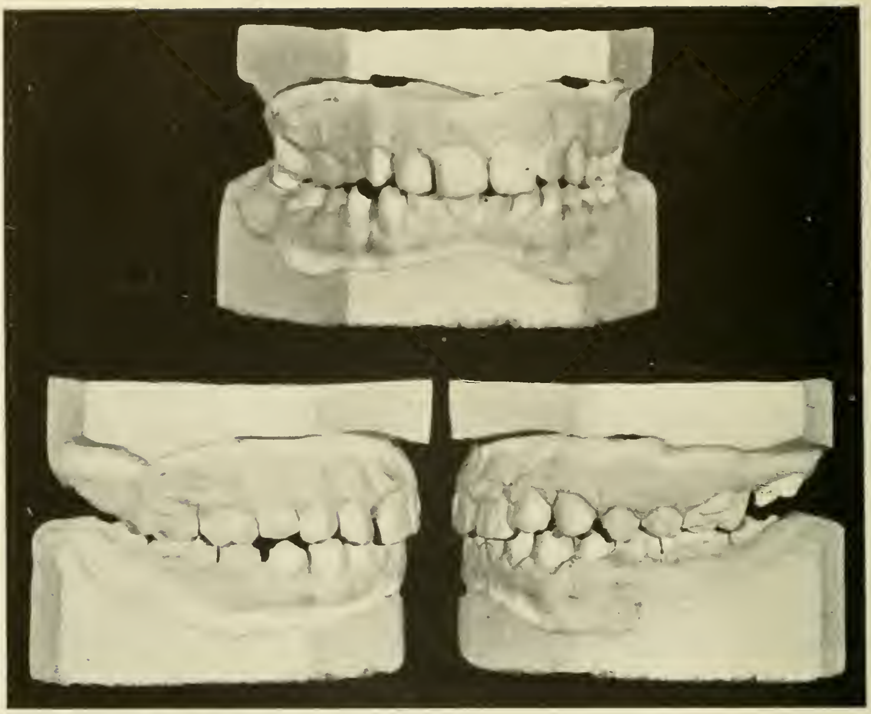


FIG. 2
Shows the cast of the same case. The permanent cuspid being removed allowing the deciduous canines and molars on the right side to remain.

permanent teeth are missing and the roots of the deciduous ones are not resorbed, it is deemed good policy to preserve the deciduous teeth as long as possible. If, however, the roots of the deciduous teeth are resorbed to any great exent (and they do resorb even though the permanent successors are missing) another method of treatment might be resorted to. I have never seen the upper deciduous laterals in place with good roots where the permanent ones are missing, but have frequently seen deciduous cuspids with roots showing little or no resorption—the permanent cuspids erupting either mesial or distal to the deciduous ones.

Part I.— In treating children under fifteen years of age with missing teeth we must be guided by the number of teeth missing. If but one upper lateral is missing and the deciduous cuspid has a good root, I would treat the case as if the full complement of teeth were present, permitting the deciduous cuspid to compensate for the missing lateral, for I have seen this tooth in the mouth as late as forty years of age, and while it is true that it is not the same shape

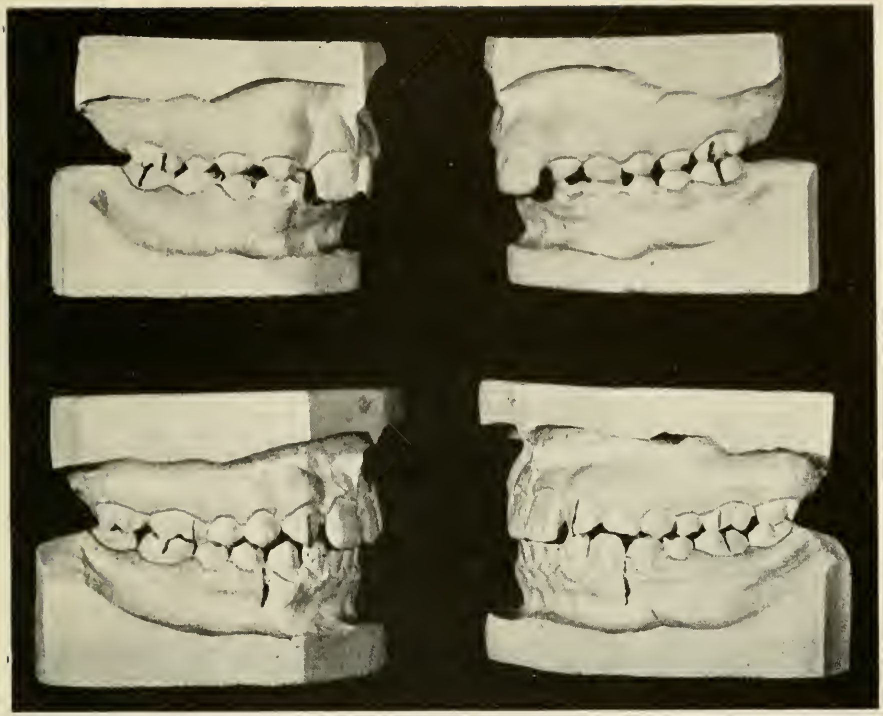


Fig. 3

Shows casts before and after treatment of a girl of 12. Permanent upper laterals missing, left deciduous cuspids still in place.

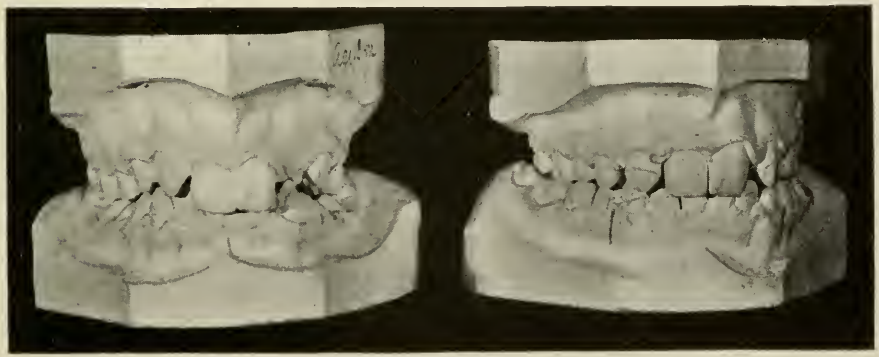


Fig. 4

Front view of Fig. 3 before and after treatment.

as the lateral and that it becomes an entirely different shade from the permanent teeth, I would still consider it better policy to retain it, because we must not lose sight of the fact that the laity do not observe teeth as critically as do dentists and orthodontists. In like manner would

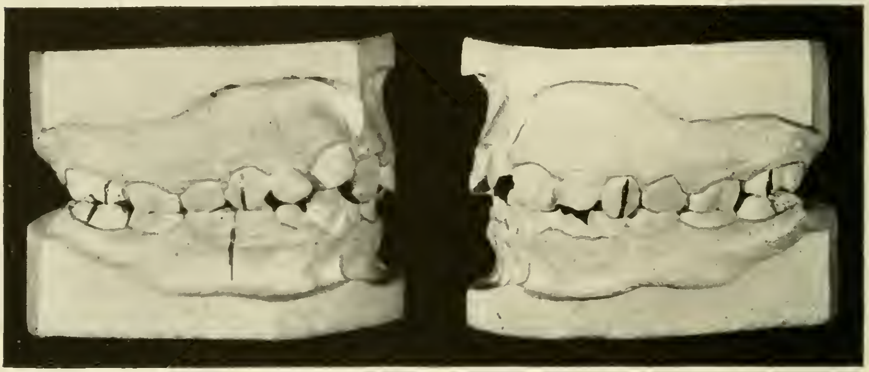


Fig. 5
Casts of girl of 7½ with one upper lateral missing.

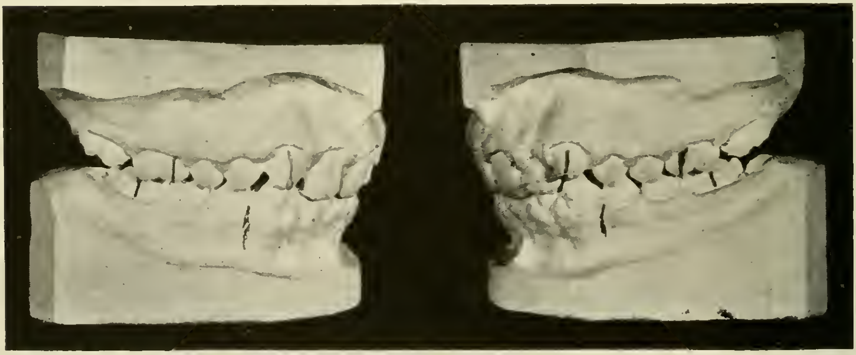


Fig. 6
After treatment of this case which is unsatisfactory owing to deep overbite.

I treat a case with both upper laterals missing and the deciduous cuspids having good roots.

Where the upper lateral is missing and the deciduous cuspid is lost I would then advise the placing of the cuspid in contact with the central and the moving of all the upper teeth on that side forward, which, of course, necessitates establishing a malocclusion on one side; but if carefully done, then by slightly grinding the cusps of the premolars and

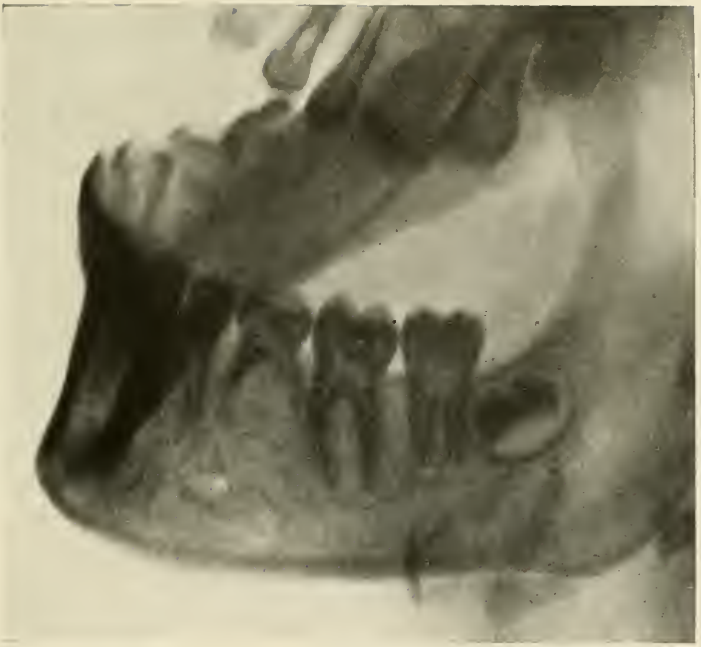


FIG. 7

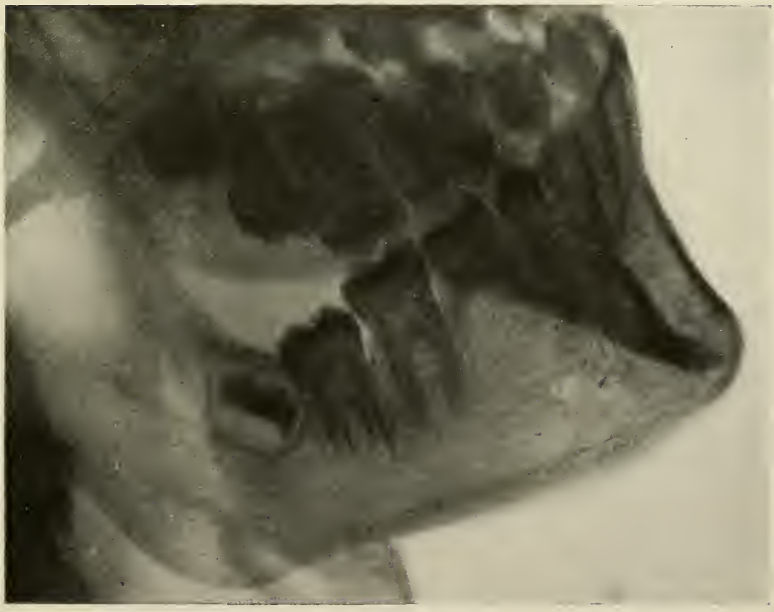


FIG. 8

Made from X-ray plates taken extra-orally of the mandible of a child of 11, showing the second lower premolars missing and the third molar present. In such cases I advise the removal of the deciduous molars and carrying the permanent molars forward so as to close the space.

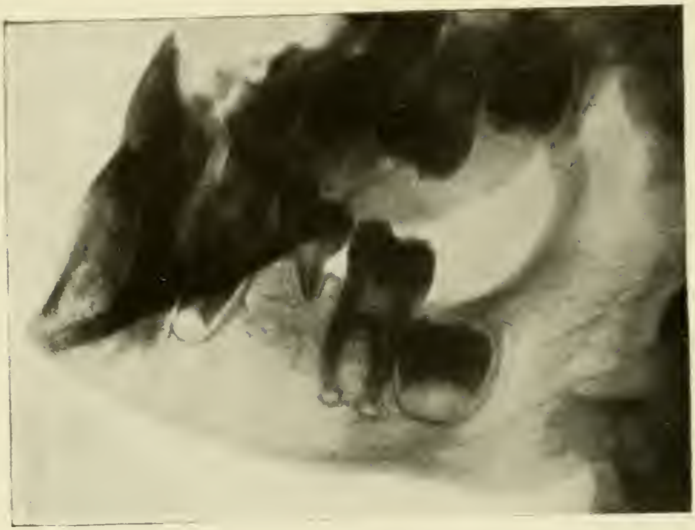


Fig. 9

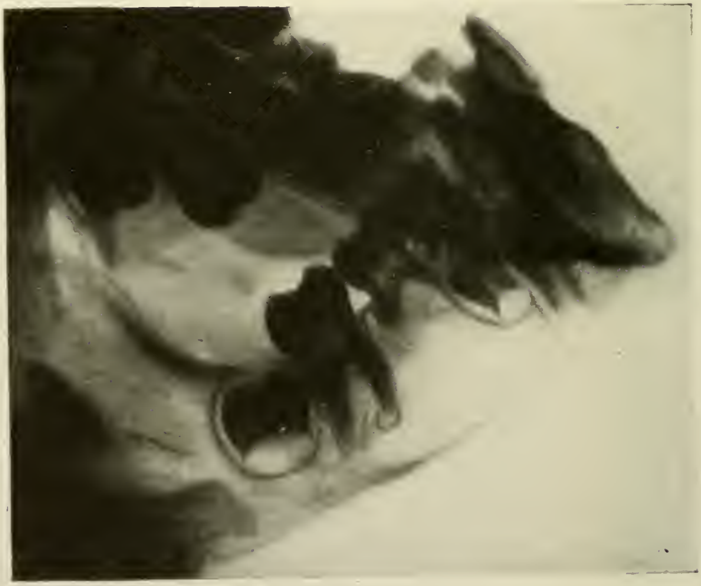


Fig. 10

Like pictures of a child of 9½ and while the third molars are not clearly shown the roots of the second deciduous molars are so resorbed that I would advise their removal and treatment as in the preceding case.

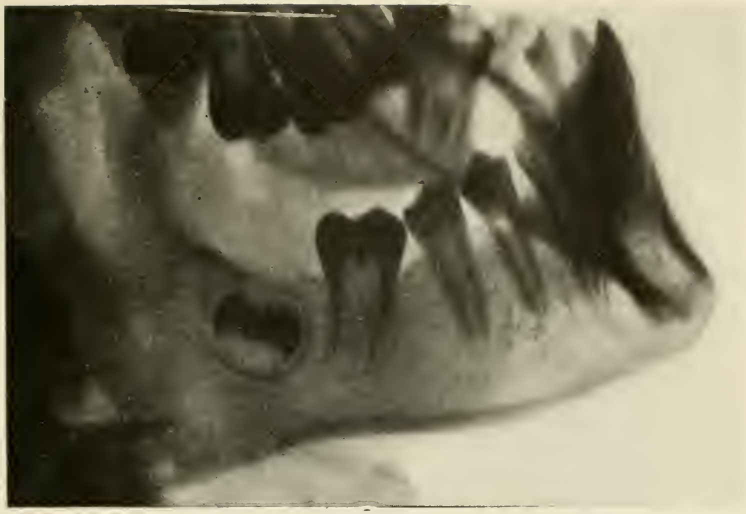


Fig. 11

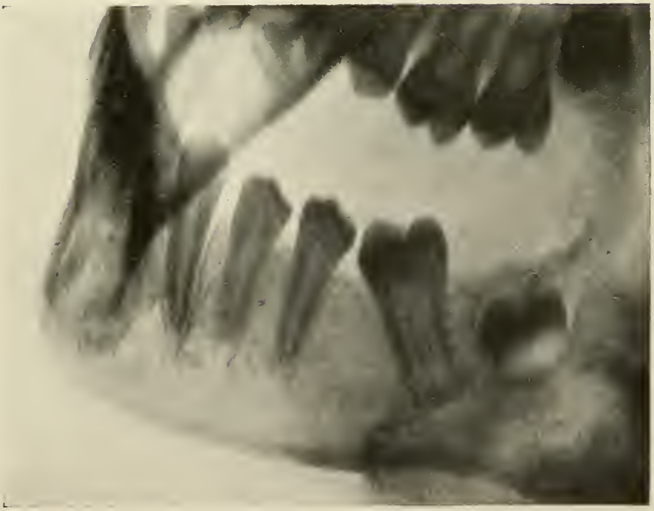


Fig. 12

Show similar X-ray plates of a boy of 11, the lower first permanent molars having been removed. In this case I then advise the carrying forward and straightening up of the second molars, thus establishing a malocclusion and a compromise treatment.

molar teeth a very efficient occlusion can be obtained. Where both upper laterals are missing and the deciduous cuspids are lost the same method of treatment would be pursued, establishing a malocclusion on each side.

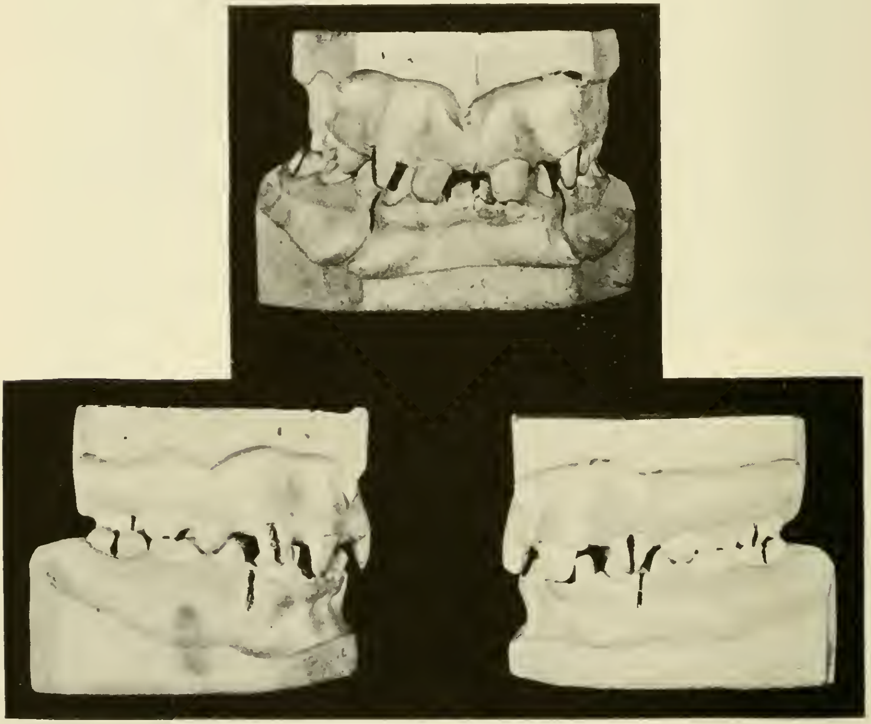


Fig. 13

Where the second premolars are missing and their deciduous successors lost or their roots resorbed, I advise the moving forward of the first permanent molars, placing them in contact with the first premolars. This would be done regardless of the number of second premolars missing. Where more than four premolars are missing and the deciduous teeth are lost or their roots badly resorbed, I then deem it advisable to provide for the full complement of teeth as much as I regret the necessity for a child to be compelled to go through life with artificial teeth.

In the case of missing lower incisors, if but one or two are missing, the same course might be followed as where the upper laterals were missing, but I have never seen the deciduous cuspids retained in these cases and

I have never treated one in this way. I recall two cases where I have maintained a place for the missing incisor, but with our knowledge of the baneful effects of supplying missing teeth I would advise the other method of treatment. Where more than two lower incisors are missing it then becomes necessary to maintain the spaces for the full complement of teeth. I have never seen a case with a cuspid congenitally absent.

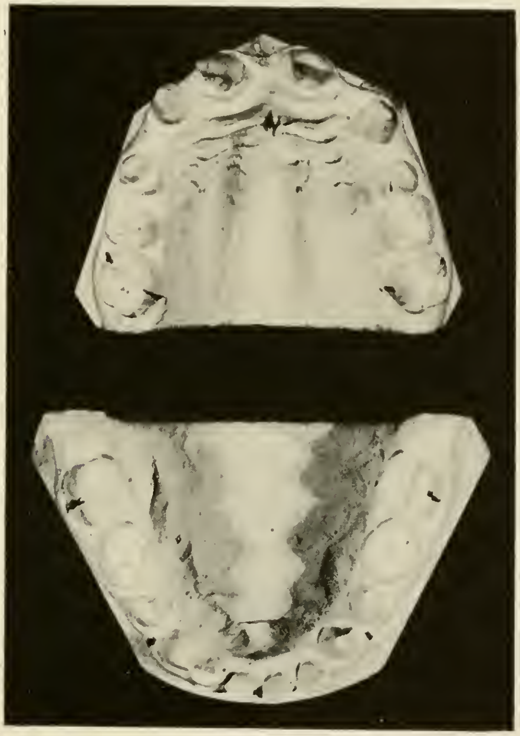


Fig. 14

Are made from casts of a girl of 16 showing the 15 permanent teeth in the mouth. Three ot the lower incisors being deciduous ones, the second deciduous molars being present both upper and lower. X-rays showed there were no teeth to erupt. This is the most pronounced case of missing teeth I have ever encountered.

Part II.— The tooth usually lost in children under fifteen years of age is the first permanent molar, and the lower more often than the upper. In such cases it is deemed advisable to have radiographs made extra-orally, so as to determine which of the

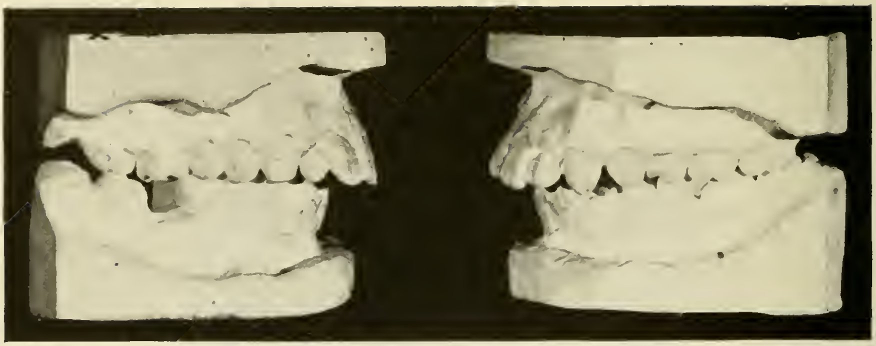


Fig. 15
Is from casts of a woman of 25, with the lower first molars removed and a deep overbite. Class II. Malocclusion.

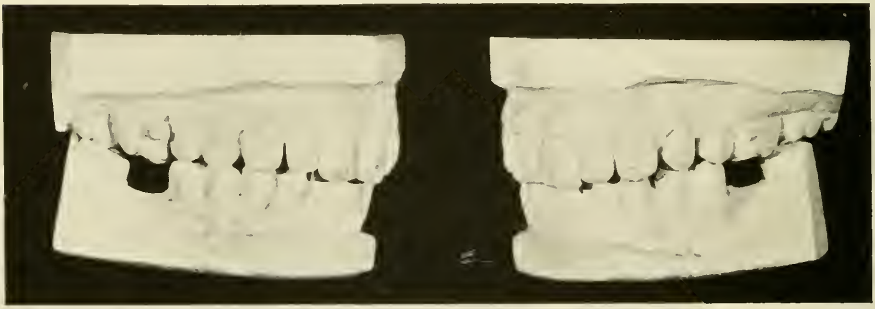


Fig. 16
Is a study model of the case described above during treatment, opening up the space for the first molars.

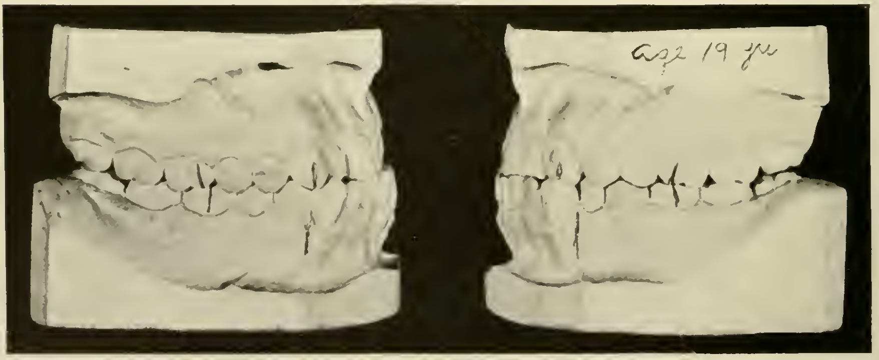


Fig. 17
Is from casts of a young man of 19, the left upper lateral missing and the right lateral of diminutive size. It was decided to remove the lower left premolar and thus obviate the wearing of artificial teeth.

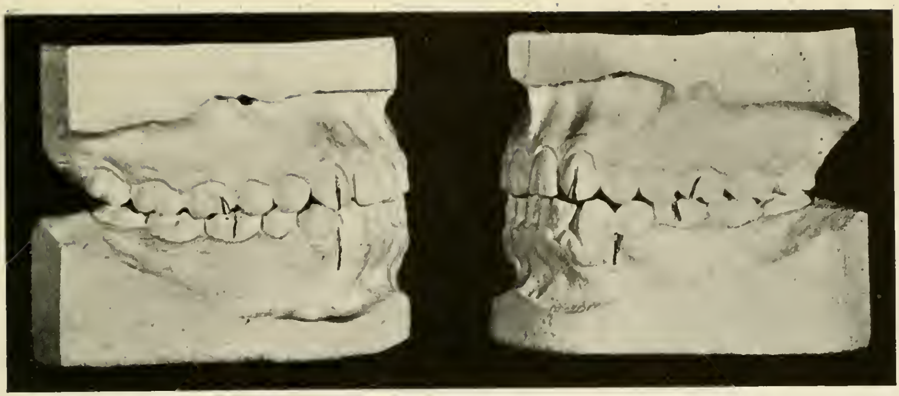


FIG. 18
Shows the result with a porcelain jacket on the diminutive lateral and the canine and second premolar in contact on the lower left.

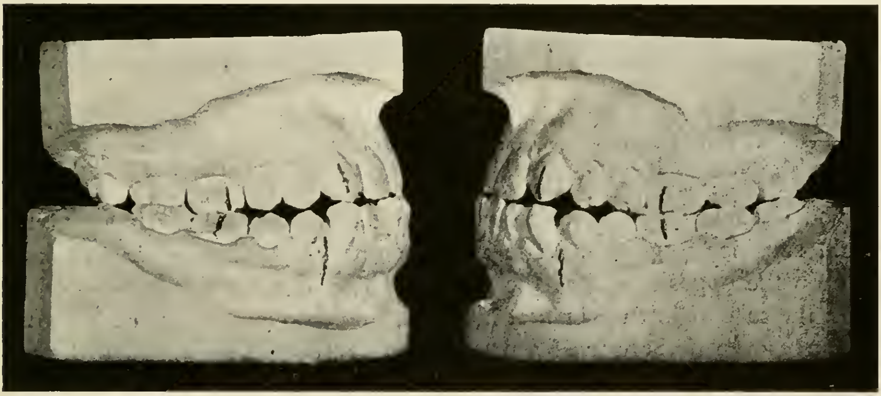


FIG. 19
Made from casts of a girl of 21 with upper laterals missing. It was decided not to open up spaces for these teeth.

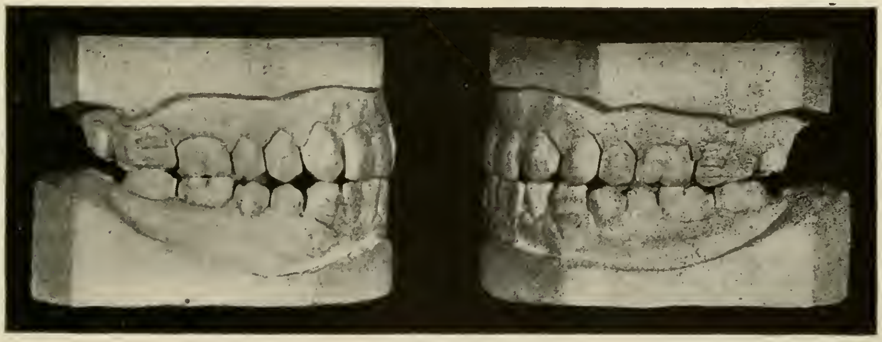


FIG. 20
Shows the result of treatment.

third molars are present, and if so, impacted or otherwise. Where present and not impacted it is deemed advisable to move the second permanent molar forward, placing it in contact with the second premolar unless the incisal overbite is so pronounced as to render this inadvisable. This

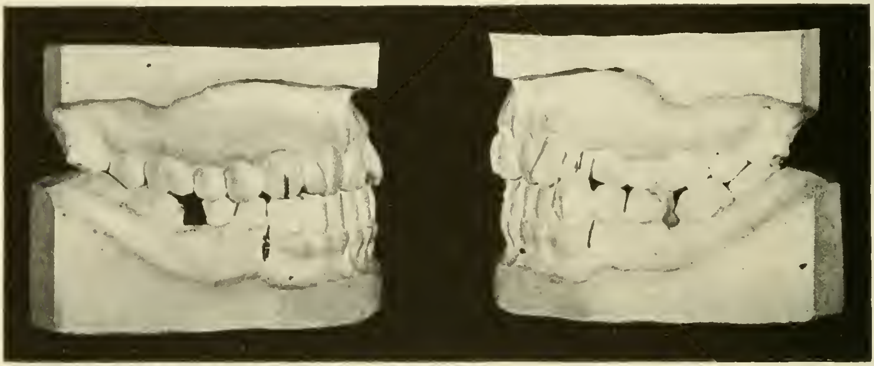


Fig. 21
Made from casts of a woman of 44 with lower first molars extracted; very slight overbite. In this case the lower molars are being carried forward, obviating the necessity of bridgework.

method I would pursue where one or more first molar is missing, and I would consider it good practice where one was missing to remove its mate on the opposite side if the pulp had been lost from it.

In the case of lost upper first molars I would advocate this method of treatment even if there were a pronounced overbite in the incisal region.

Part III.— In patients over fifteen years of age with missing or lost teeth most of my work has been the treatment of cases with lost teeth. One case at nineteen with one upper lateral missing was treated by removing the lower premolar, thus compensating for the missing tooth in the upper arch, and this, I might say, is the only case in my entire practice where I have removed a permanent tooth for the treatment of malocclusion. Careful observation will prove to any one that wherever the first permanent molar is lost the tooth distal to it tips forward and rotates lingually. This permits the corresponding tooth in the opposing arch to drift buccally and elongate, thus rendering it impossible to properly supply the missing tooth by any method. In such cases I would advise the straightening up of the tipped second molar in one of two ways: Where the overbite in the incisal region is deep the second molar should be placed in its proper position and the upper molar depressed in its socket so as to establish the proper plane of occlusion, so that the artificial tooth can be substituted for the lost one. Where the overbite is shallow the second molars can be carried forward and straightened up, this obviating the necessity of an artificial substitute.

The accompanying illustrations show results of treatment, with brief descriptions of the same.

The Relationship of Form to Position in Teeth and Its Bearing on Occlusion.

By Milo Hellman, New York.

The Lower Mammals and Anthropoids.

There is a prevalent tendency in our specialty to worship an ideal which, by tacit but unanimous consent, has been declared the goal of orthodontic attainment. The conception of this ideal, though expressed by the term *normal occlusion,* implies qualifications of such exacting character as to render its probable occurrence under average conditions exceptionally rare. Despite the definition by Angle on the one hand, and the elaborate and highly philosophic treatise by Johnson on the other, the exact meaning of normal occlusion has baffled the profession to such degree as to bring about considerable confusion relative to the *practical results* obtainable by orthodontic procedure. To illustrate, an instance will be cited.

Among other casts of cases of malocclusion, the casts represented in Fig. 1 A, were observed by an orthodontist. The first utterance made was: "abnormal frenum." To a query as to how he would treat the case he answered, "Well, I would remove the frenum by the electric cautery, and draw those centrals together." These casts are of the denture of a man over forty years of age, it was explained, and as may be seen by the illustrations, Fig. 1 B, C, the teeth are in normal occlusion. "Would you really treat such a case?" he was asked. "Indeed I would" retorted he.

Another instance, quite illustrative, is the invention recently brought to the attention of the profession which, it was claimed, may enable the orthodontist to detect any deviation from the normal in occlusion of a denture to the extent of a fraction of a millimeter. The practical utility (?) of such an instrument is undoubtedly obvious, and *yet,* its importance

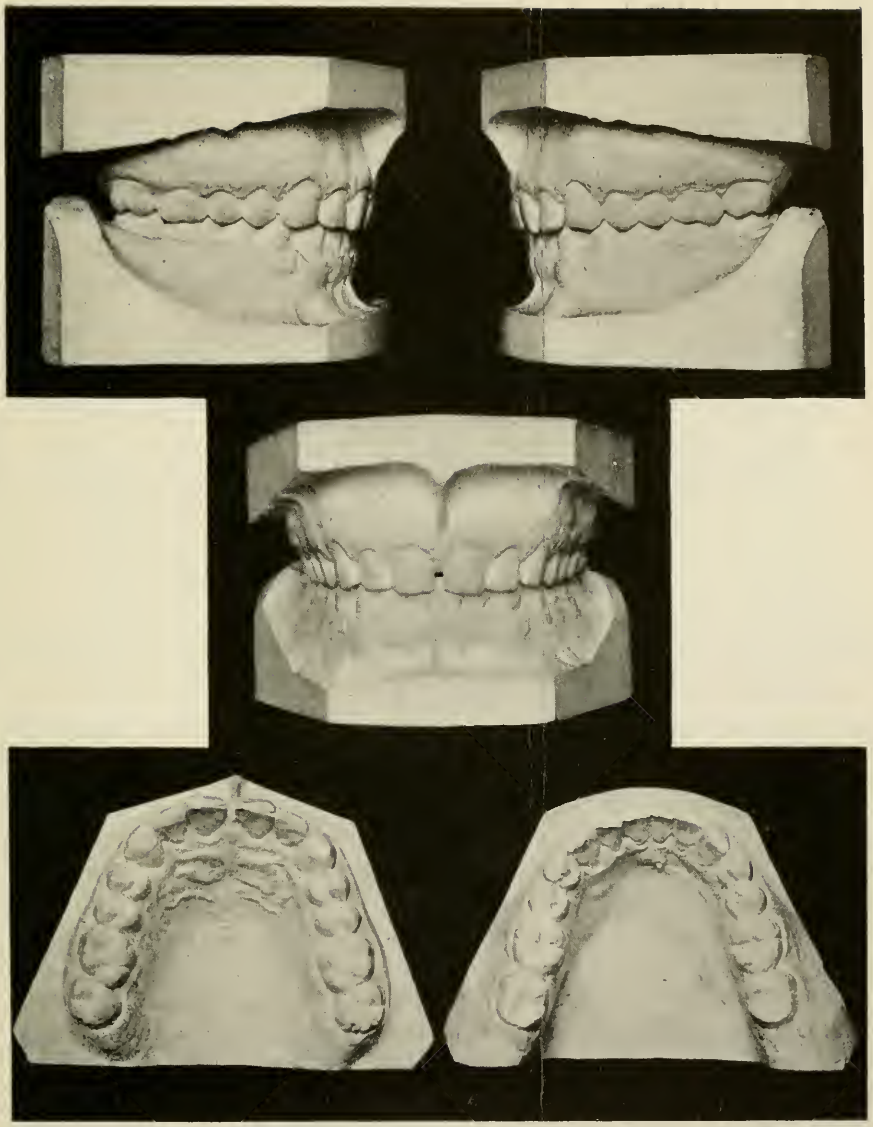


Fig. 1.—A, B, C, D and E.

Fig. 1.—Casts of Dentition of male of forty. A.—Front view, showing small diastema between upper central incisors, with somewhat excessive overbite. B.—Right side view, showing normal occlusion of premolar-molar series. C.—Left side, showing similar conditions as in B. D.—Occlusal view of upper dental arch, showing diastema between upper centrals, position of mesio-distal axis of central and laterals as compared with those in Fig. 27, the three-cusped second molar and missing third. E.—Occlusal view of lower dental arch, showing position of incisors, canines and premolars in their arch curve differing from that in the teeth of the upper arch; also notice the right third molar in the course of eruption.

was persistently urged as though the solution of all orthodontic problems depended upon its adoption in practice by the profession.

Are Orthodontic Results Permanent?

Of similar interest is an occurrence met with in practice so peculiarly impressive as to have a queer effect upon the disposition of the most temperate of individuals. No orthodontist can deny the heartfelt disappointment, when at the expiration of extensive periods of time devoted to the treatment of a case of malocclusion, after cautious and careful retention for months or even years, the patient returns shortly after the removal of the last vestiges of the retaining appliance with the following remark: "Doctor"—and placing the forefinger upon a certain tooth—"I can feel this tooth sticking out; are my teeth going back?" He is horrified by the thought of the future prospects. For, according to previous arguments, "irregular teeth get worse if they are not corrected." He tries to minimize the extent of the damage, but, as the facts in the case are undeniable, he is at a loss for a plausible explanation. Some orthodontists attribute the relapse to one cause, others to another, but pretty nearly all agree upon the necessity of correcting it again. As a consequence, the most successful and *ideal* orthodontic results obtained are rather short lived. It has been my privilege to see several cases presenting ideal results as obtained by some of the leading men in orthodontia. But when asked how long the appliances had been off they said about six months.

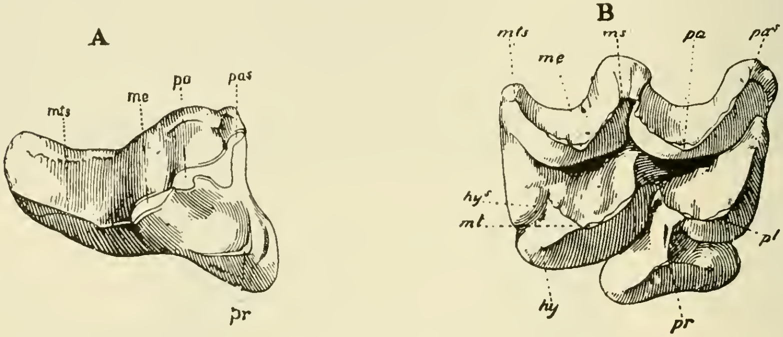


FIG. 2.—A and B.

FIG. 2.—Two teeth, showing divergent derivatives of the tritubercular molar pattern. A.—Sectorial molar of *Oxyaena* of the Eocene period. B.—Grinding molar of modern horse; pr, protocone; pa, paracone; me, metacone; hy, hypocone; pas, parastyle; mts, metastyle, etc. (After Osborn).

These instances illustrate first, the extremes to which the conception of normal occlusion tend, and secondly, the demands upon which this conception is based. Thus, the exacting nature of such demands render even the ablest, most expert and conscientious of orthodontists not *always* sufficiently competent to obtain in *all* cases *lasting ideal results.* By this is meant, of course, results that would simulate the *conceived ideal,* years after all appliances will have been discarded, and when all the teeth shall have adapted themselves to the tasks imposed upon them by the various habits involved in the mastication of food, in the respirations of air, in the enunciation of speech—and other habits that are so liable to spoil orthodontic results.

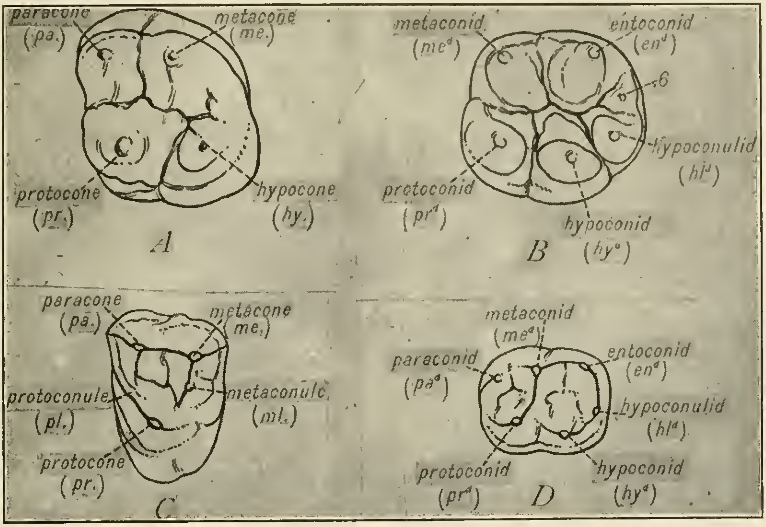


FIG. 3.—A, B and C.

FIG 3.—Cusp nomenclature as applied by Prof. Henry Fairfield Osborn to the teeth of *Man* and *Pelicodus Trigonodus,* an Eocene primate. A.—Occlusal surface of upper left molar of man. B.—Occlusal surface of lower left molar of man. C.—Occlusal surface of upper left molar of *Pelicodus Trigonodus.* D.—Occlusal surface of lower left molar of *Pelicodus Trigonodus* (After Gregory).

To disillusion ourselves from idealisms and gain an understanding of the scientific aspect of occlusion, it is necessary to relinquish all notions of abstract phenomena and resort to a study of the concrete manifestations in nature. How many of us are familiar with the results obtained by nature through her persistent and ceaseless efforts in the endeavor to produce an efficient masticatory apparatus throughout the animal kingdom? How many of us appreciate the fact that to produce the form of teeth constituting the human dentition required millions of years in time and innumerable experiments on the part of nature? Also the ingenious manipulations and endless experimentation it required to place each tooth in its allotted position in the dental arch of man? For instance, obvious as the difference in form of the two molars in Fig. 2 A and B may appear, it requires a keener perception to appreciate the character of divergence in their morphological modification. For, although one molar (A) is a sectorial tooth of a carnivorous animal (Oxyaena) of the Eocene period and the other (B) the grinding tooth of the modern horse, representing types adaptively so far apart as to confuse even experienced odontologists, "the existence of homogeny or common derivations

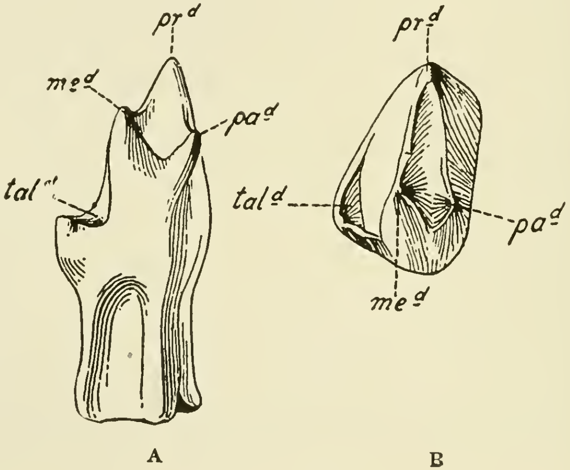


Fig. 4.—A and B.

Fig. 4.—Diagram of a primitive tritubercular lower left molar (*Phascolestes*). A.—Lingual aspect. B.—Occlusal view (After Gregory).

through which we can now compare cusp to cusp" (Osborn) is plainly evident.

It must, therefore, be granted that only upon a thorough appreciation of these facts will we realize that although we have learned, as orthodontists, to produce changes in position of the teeth in the human jaws, we are utterly incapable of bringing about the slightest modification in their form. And, whereas there appears to be a close relationship between form and position in teeth, as is borne out by abundant evidence in evolution and in comparative anatomy, it is well to remember that in all orthodontic procedure this factor plays a role of considerable importance. Furthermore, since changes in form are entirely beyond the control of the orthodontist, the position of the tooth should be based upon an interpretation of its form. Such interpretation, on the other hand, must necessarily depend upon a thorough knowledge of the natural processes that were instrumental in originating, shaping and placing the teeth in the positions as found under normal conditions.

The subject, therefore, resolves itself into studies on:

1. Evolution of the Mammalian Molar Tooth and its Bearing on Occlusion.
2. The Number, Form, Position and Occlusion of the Teeth of Modern Placental Mammals.
3. Evolution of Form and Occlusion of Primate Teeth.
4. The Form, Position and Occlusion of the Teeth of the Anthropoids.
5. The Form, Position and Occlusion of the Teeth of Primitive Man.
6. The Form, Position and Occlusion of the Teeth of Modern Man.

1.—Evolution of the Mammalian Molar Tooth and Its Bearing on Occlusion.

The discovery by Professor Edward D. Cope, in 1879, of the oldest fauna of the age of mammals, or Tertiary period, near the Puerco Cañon in Northwestern New Mexico, revealed a general similarity in all the molar teeth, even among animals of diverse feeding habits. This similarity consisted in the possession of *three main cusps on the crowns of both upper and lower molars,* disposed in triangles. This was evidently a primitive type of molar tooth, and in 1883 Prof. Cope appropriately named it the *tritubercular type.** By comparison with the teeth of more recent animals, the further conclusion was reached that the *"tritubercular type was ancestral to many if not to all of the higher types of molar teeth."* The superabundant evidence from which these deductions were made then, and the study of additional collections bearing on this problem gathered since, have established the primitive tritubercular type of molar not as an hypothesis nor as a theory but as a *fact.*

Based on authentic and reliable evidence from collection of paleontologic material studied by Professor Osborn, Dr. Matthew, Dr. Gregory and Mr. Granger of the American Museum of Natural History, it has been made quite plain that the trigonal upper molars and the tuberculo-sectorial lower molars are the true ancestral pattern and may be traced along divergent lines into the more complex molars of various

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* In 1895, Prof. Osborn applied to the cusps of the human molars the system of nomenclature which he had invented at an earlier period for the molar patterns of Eocene mammals. It is to be regretted that this terminology was not adopted by the dental profession, as it replaces such cumbrous terms as mesio-lingual cusp of the upper molar by the simple term, *protocone,* etc., see Fig. 3. Moreover, "when we understand," Prof. Osborn contends, "that all the teeth of all placental mammals have this key, this tritubercular key, we can unlock the comparisons through the series and point out the homologies."

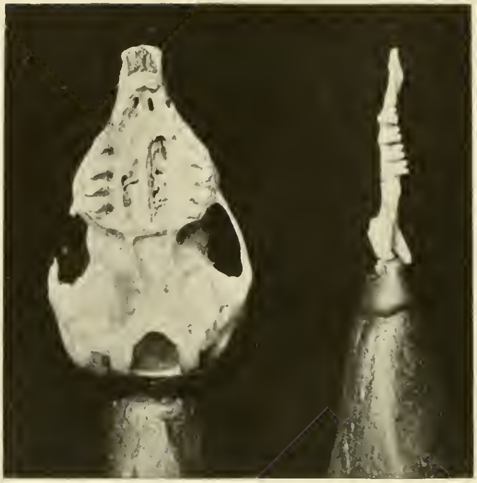

Fig. 5.

Fig. 5.—Dentition of Australian marsupial mole, *Notoryctes*. Occlusal view of upper and half of lower jaw, showing tritubercular type of molar in both. (Am. Mus. of Nat. History).

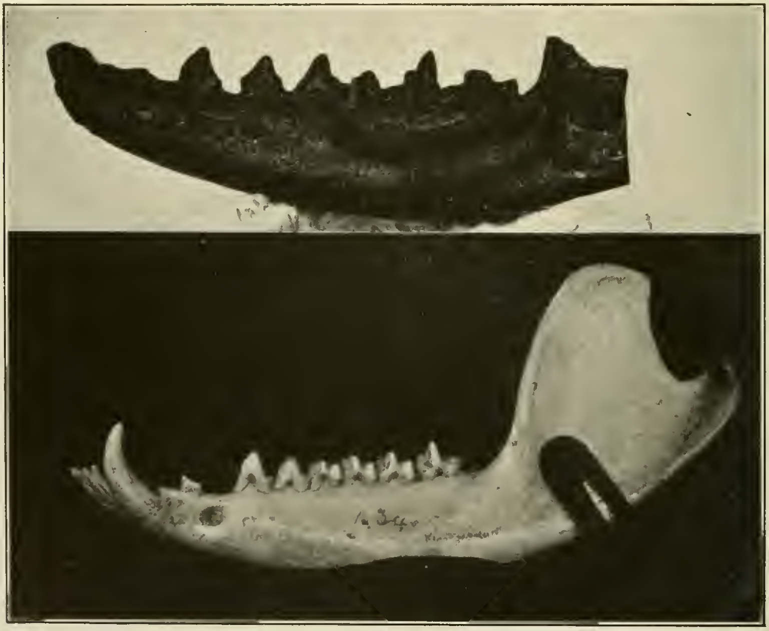

Fig. 6.—A and B.

Fig. 6.—Lateral aspect of lower jaw of (A) an Eocene carnivore (Sinopa) and (B) a modern omnivore (Opossum) showing the difference in the occlusal plane of the trigonid and the talonid in the molars. (Am. Mus. of Nat. History).

groups of insectivores, carnivores, condylarths, perissodactyls, primates and other orders. Thus, it is a fact worthy of considerable attention that in the Paleocene and Eocene epochs most of the known families of placental mammals exhibited varieties of molar patterns which are very plainly and demonstrably modifications of the primitive tritubercular type.

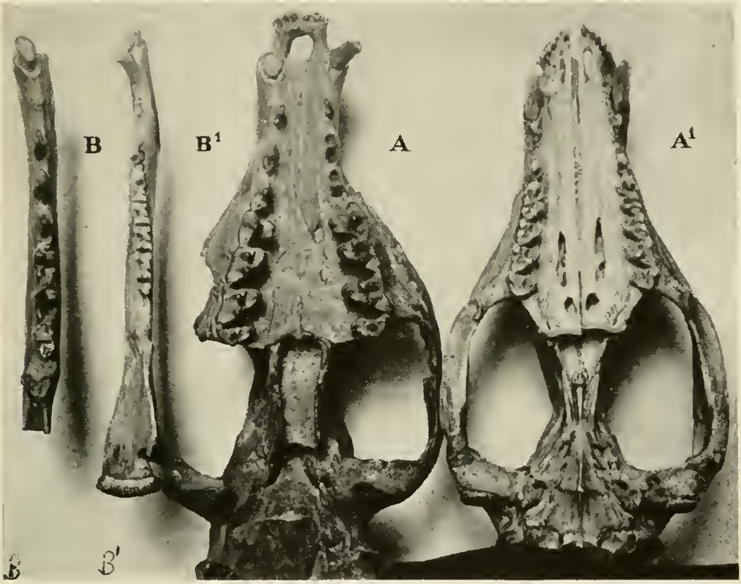

FIG. 7.—A, A^1, B, and B^1.

Fig. 4, A ,B, represents an enlarged diagrammatic representation of an extremely primitive tritubercular lower left molar from its lingual and occlusal aspects. It belongs to an animal (*Phascolestes*) of the upper Jurasic, belonging to the order *Trituberculata,* a probable ancestor to all placental mammals. As will be noticed, the apex of the occlusal triangle as represented by the main cusp, the *protoconid,* is directed buccally; the other cusps forming the base are placed lingually; distally there is a *cingulum, heel* or *talonid.* In the upper molar, the cusp triangle is reversed, i. e., its apex presents lingually and its base buccally. The occlusion of this type of molar is of an interlocking or alternating character, and prevailed in the mesozoic mammals. A living example representing this type of molar and occlusion is found in the Australian marsupial mole *Notoryctes,* Fig. 5, A, B. In this form of occlusion, the lower teeth are wedged into the triangular spaces between the upper teeth. The upper molar crowns constitute at this stage chiefly a wedge, while the lower teeth, besides contributing the wedge part also presents a posterior spur, or talonid, as seen in Fig. 5, B (t^d). This talonid is the starting point of the overlapping relation. We have thus according to Gregory in the evolution of occlusion, "first, *interlock*, and then *interlock plus overlap*."

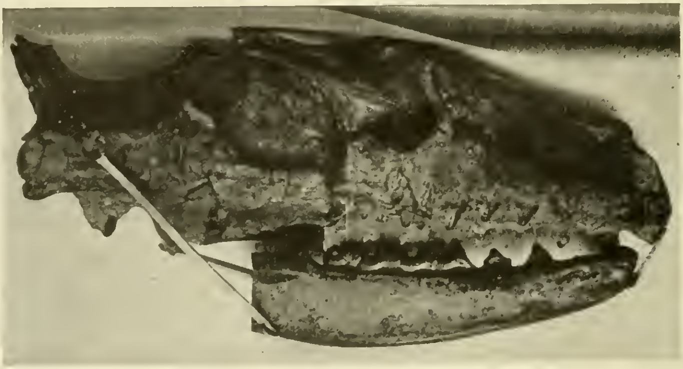

FIG. 7.—C.

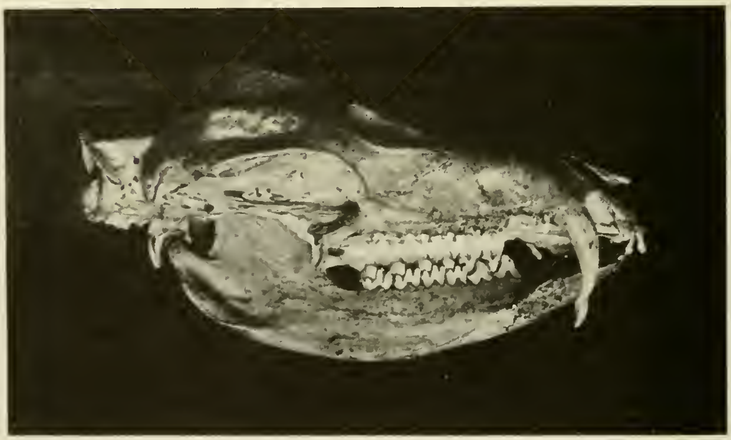

FIG. 7.—C¹.

FIG. 7.—Dentition of Sinopa and Opossum. A.—Occlusal view of upper dental arch, showing tritubercular upper molar. B.—Occlusal view of left half of lower dental arch, showing tuberculo-sectorial lower molars. C.—Lingual view of premolars and molars in occlusion, showing protocone in the talonid fossa, and trigonid fitting into the triangular spaces between the tritubercular upper molars. A¹, B¹, C¹, the dentition of Opossum illustrating the same points as A, B, C, more clearly. (Am. Mus. of Nat. History).

To elucidate, it must be explained that the part of the molar presenting the three cusps, called the trigon in the upper and the trigonid in the lower, constitutes the wedge portion of the tooth. The posterior part, subsequently developed from the palatal cingulum on the upper molar, is called *talon*, while that portion developing from the spur on the lower molar is called *talonid.* The *talon* and *talonid,* represent the lapping portions of the teeth in occlusion. In the lower molar, the trigonid, as may be seen in Fig. 6, is always on a higher plane than the talonid. The wedge-type molar relationship was reached in the age of reptiles (secondary or Mesozoic), while the lapping stage developed with the beginning of the age of mammals (Tertiary or Cenozoic). "In the more primitive mammals of the Eocene period, we find the normal tritubercular type in the upper, the lingual cusp of which is overlapped by the developed talonid. Thus, the anterior portion of the lower molars still fits into the spaces between the upper, but the posterior extension or talonid now overlaps broadly, so we have the stage of overlap well defined" (Gregory). This type of lower molar possessing the wedging portion (*trigonid*) and the lapping portion (*talonid*), was named by Professor Cope *tuberculo-sectorial.* The sectorial part being the wedge-like trigonid and the tubercular part the talonid. "The tuberculo-sectorial type is the ground plan of which we still find traces in modern insectivorous, carnivorous, herbivorous mammals and in primates." Figs. 7, A, B, C and $A^1B^1C^1$,

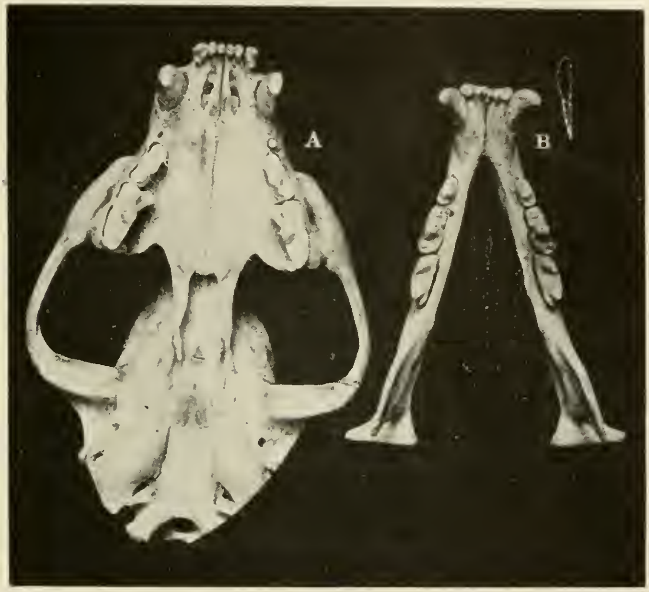

FIG. 8.—A and B.

FIG. 8.—Dentition of Leopard. A.—Occlusal view of upper jaw, showing modification in form of premolars from the rudimentary (second) to the specialized carnassial (fourth), and the diminutive upper first molar. B.—Occlusal view of lower jaw, showing modification in form of the lower premolars and the first molar, the carnassial tooth.

illustrate the dentition and their occlusion of an Eocene carnivorous (*Sinopa*) and a modern omnivorous (opossum) mammal in close resemblance of the teeth and occlusion.

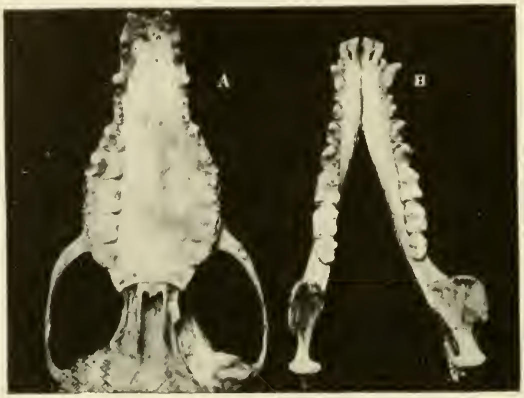

Fig. 9.—A and B.

Fig. 9.—Dentition of Gymnura, Insectivore. A.—Occlusal view of upper jaw showing development of quadrangular, quadritubercular upper molar for crushing purposes. The interdental spaces are obliterated and the mesio-buccal cusp is more prominent buccally than the disto-buccal of the molar anterior to it. B.—Occlusal view of lower jaw, showing full complement of cusps on trigonid and talonid, difference in form and arrangement of incisors as compared with those in the upper jaw. The premolars in both jaws varying from caniniform first to molariform fourth.

2.—The Form, Number, Position and Occlusion of the Teeth in Modern Placental Mammals.—The Molars.

It is plainly visible (Fig. 7, C, C^1) how the mesial wedging portion (trigonid) of the lower molar fits into the space between the upper molars, and how the distal lapping portion (talonid) overlaps the occlusal, the crown portion of the upper molars accommodating the lingual cusp, the *protocone,* into its basin-like depression. The upper molars at this stage are still of the tritubercular type, the spaces between them being of considerable functional importance. For, possessing, as the tritubercular molars do, cutting edges (the marginal ridges connecting the trigonal cusps), and piercing or crushing points—the cusps, the wedging-type of occlusion enables them to constitute an efficient apparatus for flesh-eating purposes. By the modification of the cutting edges of the *trigon* and *trigonid* in subsequent adaptation, the modern specialization occurred. Thus, the elongation of the metacone-metastyle portion in the upper last premolar and the modification of the protoconid-metaconid region in the lower molars produced the carnassial adaptation Fig. 8, A, B. On the other hand, the increase in size of the cusps, the broadening transversely of the upper molar crown and the development of the hypocone to the extent of obliterating the interdental space, produces the crushing tooth, as may be seen in the insectivore, Fig. 9 (Gymnura). In the crushing type, therefore, the points or cusps become predominant and the overlap of one part on another becomes accentuated, so that it is now the occlusal surfaces of the crowns that oppose each other rather than the sides. This change, consequently, involves the modification of the wedge-shape triangular pattern into a quadrangular type of molar. Thus, even in the quadrangular type the upper molar still possesses the primitive triangular pattern, but has in addition developed the disto-lingual cusp, the *hypocone.* The occlusion of this type of molar then presents these main features: the protocone of the upper molar is accommodated into the talonid basin (central fossa of the lower molar), while the *hypocone* fits into that of the trigonid (mesial fossa). This form of occlusion best serves the purpose for the crushing and grinding type of molar. These, then, are the gross modifications in form of the molars in their evolution from the primitive tritubercular type to the sectorial, quadritubercular and tuberculo-sectorial pattern of modern placental mammals.

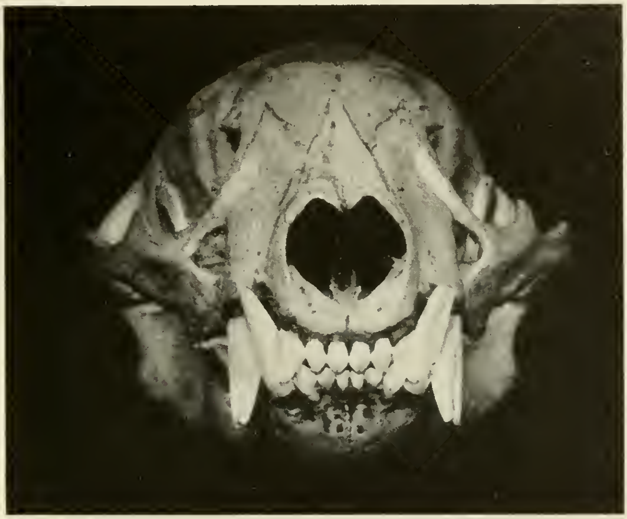

Fig. 10.

Fig. 10.—Dentition of Badger (*Toxidea Americana*). Front view, showing caniniform incisors and lingual position of lower second incisor.

The change in position, though not as accentuated as that occurring in form, during the course of evolution, may, nevertheless, be classified in accordance with the direction assumed by the mesio-distal axis, and manifested by the buccal surfaces. Thus, in the primitive triangular form of molar, the buccal surfaces of the upper teeth are arranged in an evenly aligned series, there being no buccal lapping. The position of the lower triangular teeth cannot be described as they are separated from one another and do not form a continuous series. In the modern carnivorous modification, especially in the lower premolar-molar series of the Felidae, it may be noticed that the distal end of one molar laps the mesial portion of the tooth behind, as is evident in Fig. 8 (Leopard). And last, in the quadritubercular, square type of tooth, the condition is reversed; namely, while there is not actual lapping, the mesio-buccal angle of the molar or of the molariform premolar, projects buccally beyond the disto-buccal cusp of the tooth in front of it, Fig. 9, A. These, though primitive features regarding position, persist as we pass through the various orders of mammals. Another change in position may be noticed in the longitudinal axis of the molar teeth; thus, whereas the occlusal surfaces of the primitive

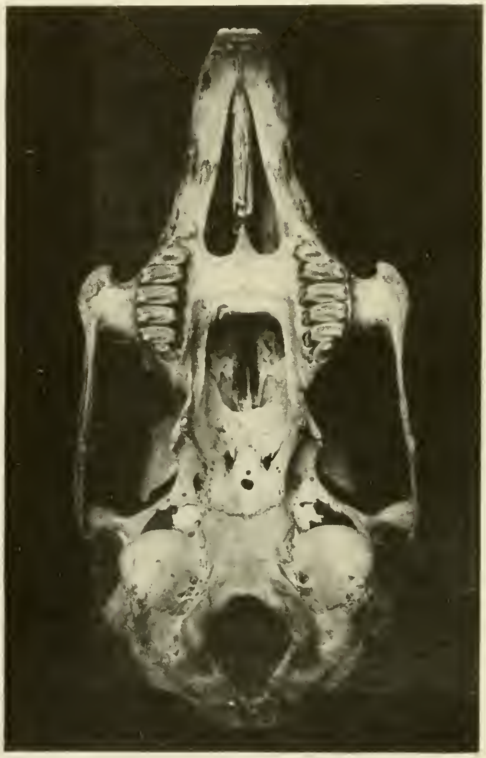

FIG. 11.

FIG. 11.—Dentition of *Rodent*. Occlusal view of upper jaw of Rabbit, showing position ot lateral incisor lingually to the central.

tritubercular molars and those of the lower modern placental mammals are directed inward in the upper jaw and outward in the lower jaw, this direction is reversed in the anthropoids and man, the crowns of the lower molars being tilted inward (lingually) and those of the upper outward (buccally).

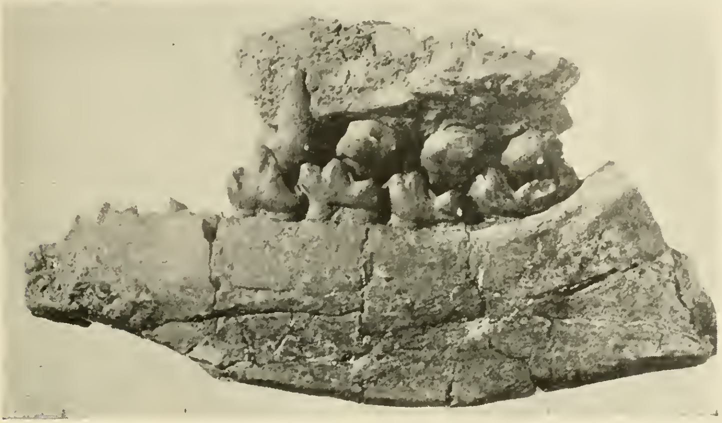

FIG. 12.

FIG. 12.—Dentition of *Pelicodus Trigonodus*. Lingual aspect, showing upper tritubercular and lower tuberculo-sectorial molar and their occlusion. It also shows the higher level of trigonid and its wedged position between the upper molars, and lower level of talonid and its lapping adjustment over the lingual cusp of upper molar.

The Incisors. The incisors of the insectivore, Fig. 9 (Gymnura), present different forms in the upper and lower jaws. In the upper they are round, pointed pegs, while in the lower they resemble very much the worn lower deciduous human canine, though being considerably smaller, increasing in size mesio-distally. The position of the incisors in the upper arch is almost parallel on the two sides, they are widely spaced, and their long axis is vertical; in the lower jaw they are placed in a sharp curve and considerably procumbent in their long axis. There are intervals or spaces between the centrals, larger in the upper than in the lower.

In the opossum, which in dentition is a little changed survivor of the most primitive marsupial of the age of reptiles, the upper incisors are very much diminished in size, and in form they resemble those of the lower in the *Insectivora*. They are all of the same size, the centrals separated and pointing toward each other mesio-incisally. Their horizontal position is more like an obtuse angle, the angle being in the central incisor region and the sides formed by the four incisors on either side. They are also axially vertical to the occlusal plane. The lower incisors are long and slender, resembling more the teeth of a comb, though more round, and the tip is capped by an enamel covering. They are very procumbent, arranged in almost two straight lines, meeting at an angle in the symphyseal region.

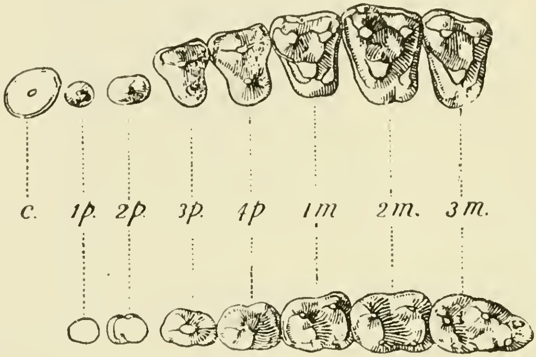

FIG. 13.

FIG. 13.—Dentition of *Pronycticebus*, Eocene primate of Europe. Showing development of the disto-lingual cusp (hypocone) from the palatal cingulum, and the tuberculo-sectorial lower molars.

The incisors of modern *Carnivora,* in the *Felidae* (Fig. 8), for instance, resemble considerably the form of the human lower deciduous canines. The centrals are extremely small, and the others increase in size mesio-distally, so that the third has always been described as *caniniform* in appearance. They are arranged in a straight line transversely, probably best to subserve their purpose, of tearing the flesh from their prey. In the *Mustelidae* (Fig. 10), the incisors are decidedly caniniform, the second, situated more lingually than the others. They are of the same size and interlock in occlusion.

In the Herbivores they reach two extremes in form as they do in number and position. Thus, in the *Artiodactyla* (the even-toed ungulates), they acquire a broad and flat shovel-like shape in the lower jaw while in the upper they are missing, as in the *Pecora* (sheep, cow, etc.) In the *Perissodactyla* (odd-toed ungulates) they are also broad, but more stout, of considerable difference in their anatomy and are present in the upper jaw as well. In both orders, they are arranged in a broad but even curve, the lower incisors assuming a procumbent position, while the uppers are more vertically placed. In the *Camel,* the lower incisors are very flat with a sharp cutting edge lapping one another considerably.

The *Rodentia* again exhibit a complete modification in the incisor region. The number being reduced to $\frac{1}{1}$ excepting in the *Duplicidentata.* The incisors are long, curved and possess a chisel-like edge. Enamel covers them only labially and proximally, and they possess a persistently growing root. In the *Duplicidentata* (rabbits, hares and picas) there is also an upper lateral incisor present. Its form is that of a fine peg, and its position is lingual to the central, Fig. 11 (Rabbit). In all placental mammals, the occlusion of the incisors appears either in an edge-to-edge bite, as in the *Insectivores, Carnivores* and *Perissodactyls;* or in an overbite, as in the *Rodents,* when the molars are in occlusion. In the *Lemurs,* the incisors are not in occlusion, but rather present an *open bite.*

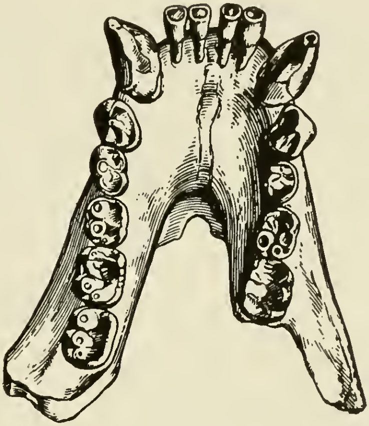

FIG. 13A.

FIG. 13A.—Lower dentition of *Dryopithecus fontani,* a Pliocene ancestor of the Anthropoids, showing type of lower molar inherited by the Anthropoids and Man.

The Canines. The canines vary considerably in their morphological aspect, so as to range from their entire absence, as in the *Rodentia,* through the vestigal appearance in certain ungulates to the enormously sabre-like structure in the sabre-toothed tiger, or in the wild boar. In some mammals, they become incisiform; as in the *Pecora* (certain deer, antelopes, sheep, cow, etc); in others they assume the incisor position and function as in some of the Lemurs, Aye-Aye (*Daubentonia Madagascariensis*).

The Premolars. The premolars also vary extremely in form, as may be seen in carnivora Fig. 8 A, the *p 2* having the vestigal appearance of a truncated cone, without any functional importance while the *p 4* is transformed into the carnassial tooth, which is of greatest functional significance. Again, in the ungulates, especially in the *Perissodactyla,* they so completely resemble the molar in form and proportion as to be indistinguishable from them, excepting premolar *1*, the *wolf-tooth* in the horse, which is a deciduous tooth, and is more caniniform. Their position is as erratic as their form, but in the main they follow the position of the molars, with modification in accordance with the form of the alveolar arch.

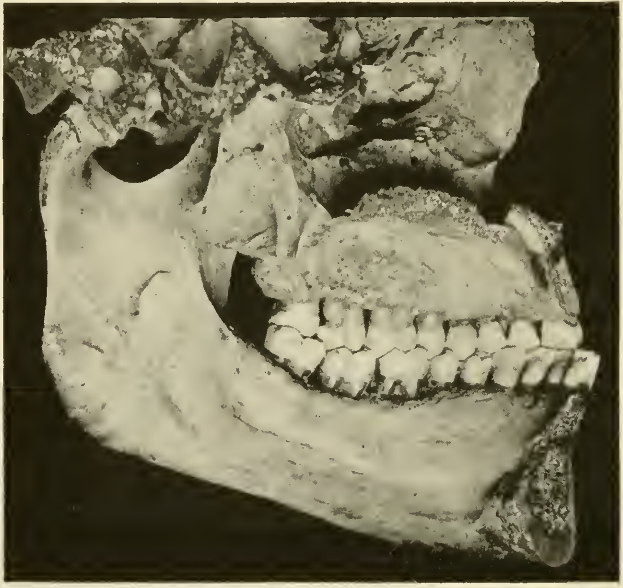

FIG. 14.

FIG. 14.—Dentition of European White. Lingual aspect, showing the type of occlusion reached in evolution by the acquisition of the hypocone in the upper molar and Dryopithecus type of lower molar. (By courtesy of Dr. Fred A. Peeso).

To sum up what has thus far been discussed, the following points may be emphasized:

1. That the dentitions of all placental mammals have sometime in the course of their evolution passed through the *tritubercular molar* stage.
2. That while all placental mammals have started out with the same molar pattern, they have evolved such divergent types as to produce the extremes seen in the *carnivora, ungulates* and *insectivores.*

3. That with the modification in the form of the molars into the sectorial and grinding types, the mesio-distal axis is also changed in dimension and position.
4. That despite the great diversity in form of the molar pattern of the modern placental mammals, the occlusion remains fundamentally the same.
5. That the antemolar teeth also assume positions in accordance with their form and functional adaptation, the incisors especially presenting the edge-to-edge or the overbite occlusion.

6. That, although the various placental mammals have started out with the same dental formula $\frac{3,\ 1,\ 4,\ 3,}{3,\ 1,\ 4,\ 3,}$ they have reached a stage of such divergence as to present at one extreme no teeth at all (the Great American Ant Eater), and at the other the full mammalian complement of teeth (*Horse*). And, finally, that manifestations that might have been considered as anomalies have gradually become normalities. Chief among the normal anomalies are:

a. Lapping of lower incisors in *Camels.*
b. Lingual position of second lower incisors in *Mustelidae* (*Badger, Martin, Sea Otter,* etc.).
c. Position of upper lateral incisors behind the centrals in *Duplicidentata* (*Rabbits*).
d. Assumption of incisor form by lower canine in *Pecora* (cow, deer, sheep, etc.).
e. Assumption of incisor position and function by the lower canine in some *Lemurs* (*Aye-Aye, Daubentonia Madagascariensis*).
f. Development of second upper incisor to enormous proportions in *Probocidea* (elephants).

3.—The Evolution of Form and Occlusion of Primate Teeth.

Considerable emphasis is being brought upon the shortening of the muzzle in the evolution of certain types of placental mammals. This process is invariably associated with modifications in the dentition. Thus, there is a two-fold effect brought about in the character of dentition where such processes were operative. Though the result as far as the muzzle is concerned is alike in both instances, in that there was an elimination of teeth, the regions involved differ. In the *Felidae,* for instance, shortening of the muzzle may be associated with the posterior part of the dental arch, the number of teeth in the molar region *mainly* and in the premolar region *in part* being reduced. In the *Primates,* the part of the dental arch mostly affected is the anterior region, one of the incisors and the first and second premolars being eliminated. Furthermore, the great variability in the number of incisors and premolars prevalent in various mammals, becomes more stabilized in the *New* and *Old World Monkeys, Apes* and *Man*. The dental formula of the New World monkeys differs from that of the Old World monkeys in the number of the premolars* and in the pattern of the cusps and teeth.

Like the evidence by which the homology of the dentitions of the lower placental mammals was followed, so also may be traced the influences of evolution on the teeth of the primates. The dentitions of the earliest discovered members of this order divulge stages in the evolution of the molar that mark the further steps in the course of perfection of the tooth patterns in the Anthropoid Apes and Man. Thus, as far back as in the lower Eocene epoch the primitive Primate *Pelodicus trigonodus* like its contemporary placental mammals possessed the tritubercular upper molar and the tuberculo-sectorial lower molar. As can be observed in Fig. 12, presenting the lingual aspect of a portion of the right dentition in occlusion, the anterior moiety (trigonid) of the lower molar is still on a higher plane than the posterior portion (talonid). The occlusion, as mentioned before, is of the wedging and lapping type (Gregory), the trigonid fitting into triangular interdental spaces between the upper molar, while the talonid laps the lingual cusp of the upper triangular molar accommodating it in its basin (fossa).

The next step in the course of evolution marks the beginning in the development of the fourth cusp, the disto-lingual cusp (hypocone) of the upper molar and the further progress in the perfection of the cusps in the heel of the lower molar hypoconid, entoconid and hypoconulid). Thus, the earliest manifestation of the disto-lingual cusp (hypocone) of the upper molar in primates is found in the *Tarsioid Pronycticebus*, Eocene of Europe (Fig. 13), and *Omomys* sp. Eocene of Wyoming.

Coincident with the primate acquisition of the fourth cusp in the upper molar, other modifications become manifest. Thus, in the upper molar region the triangular interdental spaces become obliterated, while in the lower, the levels of the *trigonid* and *talonid* become more uniform, eventually reaching the same plane. At the same time, the mesio-lingual cusp (paraconid) of the original trigonid in the lower molar is lost. Thus, at about the *Lower Pliocene of Europe, Dryopithecus fontani*, a forerunner of some of the modern anthropoids, presents the pattern of the lower molar which is inherited by the modern great apes and man (Fig. 13, A). The occlusion of the four cusped upper molar and the Dryopithecus type of lower molar is further perfected in that the disto-lingual cusp of the upper molar (*hypocone*) is accommodated into the original trigonid basin (mesial fossa) of the lower molar; the mesial marginal ridge alone constituting the mesial boundary without the paraconid which is lost. The mesio-lingual cusp (*protocone*) of the upper molar, as in primitive dentitions, is still accommodated into the talonid basin (central fossa). Thus, Fig. 14, though illustrating the occlusion of the teeth of modern man (lingual aspect), thoroughly conveys the idea of the chief characteristic features involved in the occlusion of the quadricusped upper molar and the Dryopithecus-like modification of the tuberculo-sectorial lower molar.

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* The Hapalidae differ from the Cebidae, also in that of the molars; thus, the premolar formula of the former being $\frac{3}{3}$ and their molar formula $\frac{2}{2}$ while that of the Cebidae is p $\frac{3}{3}$ m $\frac{3}{3}$. The formulae of the same teeth in the Old World Monkeys is p $\frac{2}{2}$ m $\frac{3}{3}$.

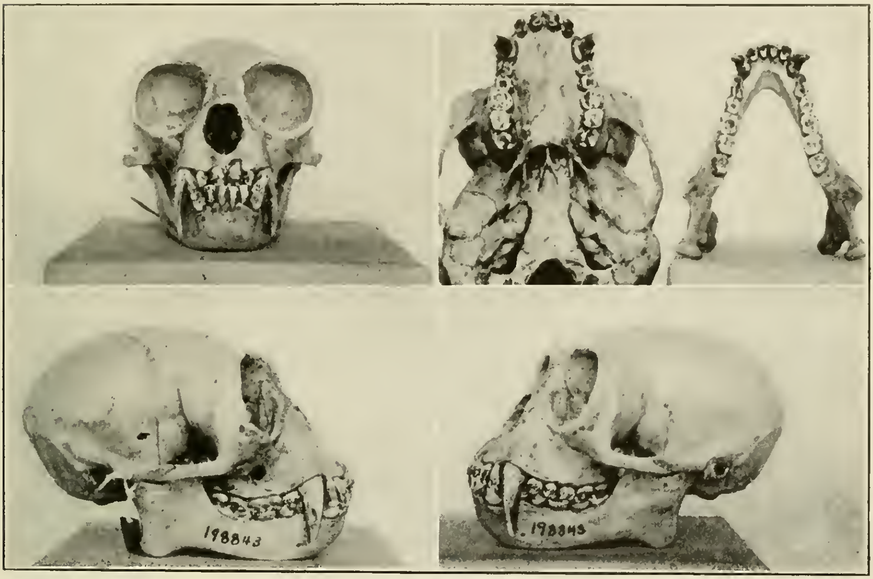

Fig 15.—A, B, C and D.

Fig. 15.—Gibbon Dentition in Occlusion. A.—Front view. B.—Right side view, showing normal occlusion as in man. C.—Left side view, showing normal occlusion as in man. D, E.—Occlusal view of both jaws, showing lingual cingulum on upper incisors and lower canines, position of upper canines and molars as regards their mesio-distal axis lingual position of premolars, labio-lingual axis of lower canines directed antero-posteriorly.

4.—On the Form, Position and Occlusion of the Teeth of the Anthropoid Apes.

The teeth of the Anthropoids resemble closely those of Man. They are alike in number and occlusion, but differ somewhat in form and position. The Anthropoid Apes include the Gibbon, the Orang, the Chimpanzee and the Gorilla.

The Gibbon. The Gibbon is the lowest genus of the anthropoid family, and in its dentition is furthest removed from man. The form and position of the gibbon teeth, though apparently resembling those of the teeth of man (Fig. 15, A, B, C, D, E), have certain characteristics that distinguish them as ape-like. Thus, the sabre-like canines, the cingulum (Fig. 15, D) on the lingual side of the upper incisors and lower canines, and the sectorial type of the lower first premolar are distinctly Anthropomorphous. The upper molars, as may be seen in the same figure, though rounded in contour, are rhomboid in form and quadritubercular. They possess the primitive trigon and the talon. In position they retain the primitive character, i. e., the mesio-distal axis is obliquely external; in other words, the mesio-buccal axial angle projecting buccally beyond the buccal surface of the tooth anterior to it. Thus, as the occlusion is of the primitive type, the protocone of the upper molar fitting into the basin of the talonid (central fossa) of the lower molar and the hypocone of the upper molar into that of the trigonid

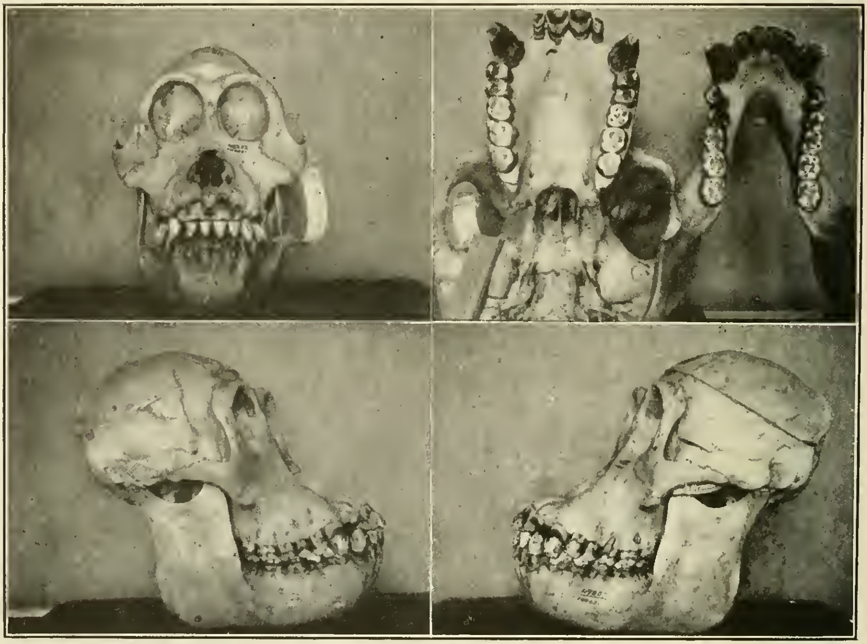

Fig. 16.—A, B, C and D.

Fig. 16.—Dentition of Orang. A.—Front view. B.—Right side view, showing normal occlusion as in man. C.—Left side view, showing normal occlusion as in man. D, E.—Occlusal aspect of both jaws, showing position of various teeth in their conformation of the Pyriform-arch.

(mesial fossa) of the lower molar, the position of the anterior moiety of the lower molar depends upon the position of the hypocone. Therefore, if the part of the upper tooth-crown bearing the protocone is everted, then that bearing the hypocone will be inverted. The trigonid of the lower molar behind will consequently correspond to the position of the hypocone as it is accommodated into its fossa. This may, therefore, cause a difference in the antero-posterior axis of the molars in the upper and in that of the molars in the lower jaw, effecting at the same time a diversity in the associated arch forms. This is just what happens. As has been shown elsewhere* the forms of the upper dental arches of the anthropoids are not always of the same outline as those of the lower.

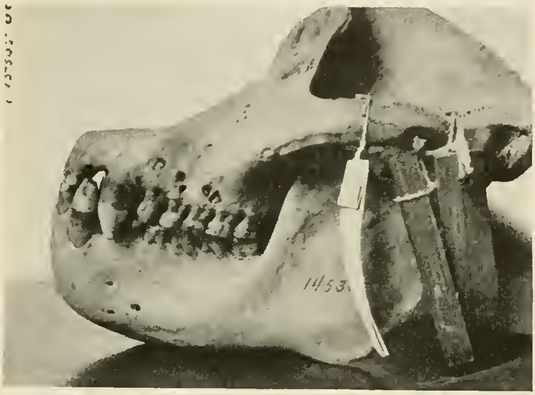

Fig. 17.

Fig. 17.—Orang Dentition, side view, showing extreme curve in the longitudinal axis of the incisors.

The incisors, though resembling the human teeth in form, are smaller in size and present a marked lingual cingulum in the upper. This cingulum, when prominent, converts the lingual surface into a mesio-lingual groove accommodating the incisal edges of the lower incisors when the jaws are in apposition and the teeth are in an overbite relation. The incisors are arranged in an evenly curved arch and may occlude in an edge-to-edge or overbite manner. They are more vertical in their long axis in the gibbon than in any other genus of the anthropoids.

The canines are, in proportion to the other teeth, of enormous length, the upper being sabre-like in form and longer than the lower. Their labio-lingual diameter is considerably less than that mesio-distally. In the upper jaw the mesial edge points antero-externally and the distal edge postero-internally, which, with the aid of the premolar position, give the dental arch a *lyriform* appearance. (See Fig. 15, D). Though there are several modifications in the variety of arch forms, this seems to be the prevailing one for the gibbon, mainly on account of the form and position of the canines and premolars. The canines are not only raptorial, but also sectorial in function. The upper canine occluding with the lower canine anteriorly and the first premolar posteriorly, constitutes an efficient piercing and shearing apparatus.

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* "Dimension Versus Form in Teeth and their Bearing on the Morphology of the Dental Arch," International Journal of Orthodontia, Vol. V, No. 11.

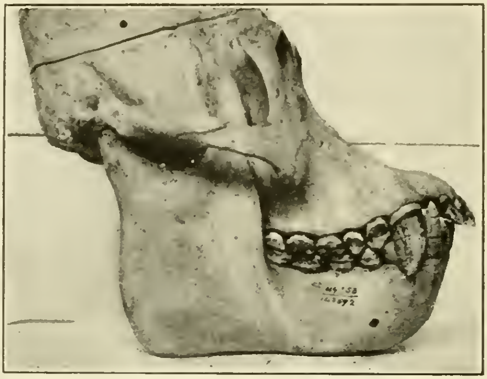

Fig. 18.

Fig. 18.—Orang Dentition, side view showing overbite relation of incisors.

The lower canine on the other hand presents a considerably greater labio-lingual diameter than that mesio-distally, due to its very large lingual cingulum. Its position is in alignment with the incisors from the labial aspect. From the lingual, the cingulum of the canine is in proximation with the mesial surface of the first premolar. Though there is no diastema between the lower canine and first premolar, there is ample room thus created for the accommodation of the upper canine for its functional activity. The premolars in the upper jaw are bicuspid, and in the lower, the first is sectorial and the second molariform, their occlusion being of the wedging or interlocking type.

The position of the sectorial type of first premolar in the apes is very much like that of the carnassial tooth in the carnivora. That is, they are obliquely set, their mesial surface being turned more lingually than that of the teeth posteriorly. The upper premolars exhibit a tendency to a position lingually in the conformation of the dental arch as compared to the rest of the buccal series. And frequently this produces a decided anomalous condition, in which the upper occlude lingually to the lower. The absence of the diastema between the lower canine and first premolar would indicate an effective protection to the soft tissues in that region during functional activity.

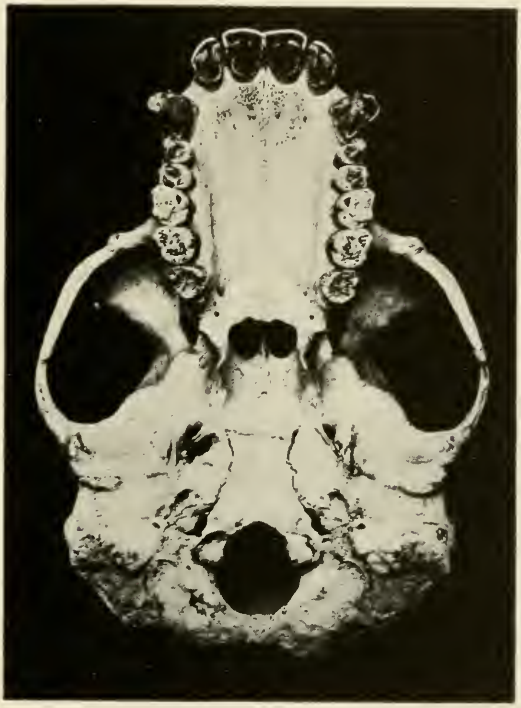

Fig. 19.

Fig. 19.—Upper Dentition of Chimpanzee. Occlusal view, showing position of canines and premolars in the lyriform arch. Note also primitive position of molars.

The Orang. The most significant manifestation in the dentition of the Orang (Fig. 16, A, B, C, D, E), is a considerable increase in the size of the teeth as are also the proportions of the entire animal. The enamel covering the crowns presents manifold and maniformed crenations on the lingual surfaces of the upper incisors and the occlusal surfaces of the premolars and molars of both jaws, an adaptation probably for a frugivorous diet. So variable and numerous are these crenations as to obliterate at times the *Dryoithecus* pattern of the ridges and grooves on the occlusal surfaces in the premolar-molar series. The upper molars, like those in the gibbon, are rhomboidal, quadritubercular and rounded in contour. Their tritubercular origin is still recognizable though the hypocone is added. The lower molars are derived from the tuberculo-sectorial type, the entire occlusal surface being on one level; they are of greater dimensions mesio-distally than bucco-lingually. The paraconid, as in the gibbon, is also lost and the talonid is fully retained. Their position and occlusion are fundamentally of the primitive type.

The canines as a whole are comparatively shorter than those of the gibbon, though variable in length, and in the upper jaw of proportionately greater labio-lingual diameter. Their form is more tusk-like in character, and their position quite different from that of the gibbon. Thus, the mesial surface of the upper canine is not directed antero-externally, but ranges from an anterior to a medial position, depending on the form of the dental arch (compare Fig. 16 and Fig. 15, D). The lower canine, though still occupying an homologous position to that of the gibbon, has its cingulum directed more lingually. Also their vertical position is modified, the cusp points projecting away from the alveolar process.

The upper central incisors are very much larger than those in man and the laterals comparatively very small. They may vary considerably in their longitudinal axis. Thus, while some present a gradual curve, from root end to incisal edge, as in Fig. 16, B and C, in others there is such an exaggeration of this tendency as to present a sharp bend at the junction of the crown and root as to simulate almost a right angle (Fig. 17). Like in the gibbon the incisor relation is of an edge-to-edge or overbite type, though greatly accentuated as seen in Fig. 18.

The premolars are bicuspid in the upper, sectorial (the first) and molariform (the second) in the lower. Though having no striking characteristics, they exhibit a slight tendency to be rotated upon their long axis. In occlusion, they present the interlocking type.

The Chimpanzee. The most striking feature in the dentition of the chimpanzee is the more regular deposition of enamel upon the crowns of the teeth, the less curved incisors and the lingual position of the premolars in the conformation of the upper dental arch. The characteristic lingual migration of the premolars like that in the gibbon is so prevalent as to produce the lyriform arch (Fig. 19), and at times even exceed the limit of normal variation and establish anomalous modifications, as in the case of the gibbon dentition. The upper canines, especially in the male, are bulkier in their dimensions and present a characteristic curve in the longitudinal axis of the crown resembling that seen in the canines of the wild boar, though not quite so emphasized, the tooth being much smaller. The lower canine has no noteworthy distinctions from those mentioned in conjunction with the Orang dentition.

The molars are very much of the same form, similarly placed and in like occlusion as in the Orang. The crenations observed on the lingual surface of the upper incisors, and the occlusal surface of the premolars and molars of the Orang are also observable in the Chimpanzee, though to a lesser extent.

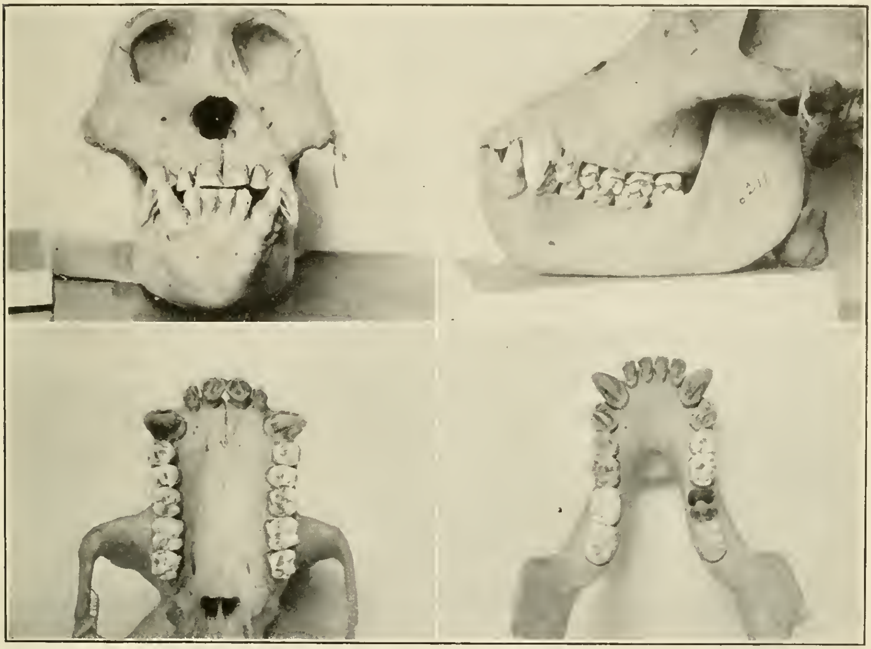

Fig. 20.—A, B, C and D.

Fig. 20.—Dentition of Gorilla. A.—Front view. B.—Left side view, showing normal occlusion. C.—Occlusal view, showing contour of molars, forms of cusps and triangular ridges, etc. D.—Occlusal view of lower dental arch, showing different positions of canines and molars and difference in arch forms.

As will be shown on some future occasion, the Chimpanzee presents the closest resemblance to man in its anomalous characteristics associated with the occlusion of the teeth.

The Gorilla. In the Gorilla, the humanization of the form of the teeth has progressed considerably, except as to proportions (Fig. 20). Though of considerably larger dimensions, the molars have acquired more human-like cusps, ridges and grooves. The upper molars are quadritubercular and more quadrangular in contour than those of the other apes and man. Their antero-posterior diameter in contradistinction to that of the other apes and man is greater than the transverse. The cusps are pronounced, the ridges triangular and the oblique ridge in the upper well defined. Owing to the large metacone (disto-lingual cusp in the upper), and to the peculiar form of the dental arch, their primitive position is somewhat obscured though not changed (see Fig. 20, D). The lower molars are mesio-distally more elongate than those of the other anthropoids, and usually present additional cusps in the lower third molars besides the five fundamental ones. The occlusion, nevertheless, remains typically primitive.

In form, the incisors resemble those of the chimpanzee, the upper centrals being broad and shovel-like, while the laterals are proportionately very small. In their longitudinal axis, they are almost straight (see Fig. 20, B, C). The lower incisors are more alike in size. Their position is quite prognathous. and the occlusion as in the other apes may be either edge-to-edge or overbite. The canines are tusk-like, and in the upper their mesio-distal direction is usually parallel with the buccal cusps of the premolar-molar series, varying slightly. The lower canines are aligned wlth the incisors, and though their lingual surfaces do not face the mesial surface of the first premolar, it still deviates from the radial direction in man. The long axis of the crown is less curved than in any of the other apes, giving them a projecting position (Fig. 20 A). Of the premolars, the upper are bicuspid, the lower first sectorial and the second molariform. Their occlusion is of the interlocking type.

The crenations observed in association with the upper incisors, premolars and molars in the orang and chimpanzee are not to be found on the teeth of the gorilla, though some folds may be seen in their place resembling more those on the teeth of man.

Anthropoid Dentition.

To sum up what has been said in relation to the anthropoid dentition, it may be reiterated that, although there is a close resemblance in the dentitions of the Gibbon, Orang, Chimpanzee and Gorilla, there are many points of variance, thus:

1. The incisors, though similar in external appearance, vary extremely in size. The mesio-distal dimension of the upper central incisor of the Gibbon, for instance, varies from 3.5 to 7 millimeters, while that of the Orang varies from 8.5 to 16 millimeters.
2. *The incisors also vary in form.* In the Gibbon, the upper incisors though presenting a smooth surface, lingually possess a marked cingulum. In some cases this projection is so prominent as to exhibit a decided groove between itself and the incisal edge. The incisal edge of the lower incisors is accommodated into this groove when present. In the Orang, the cingulum is not as conspicuous, but the entire lingual surface of the homologous incisors is traversed by crenations (or wrinkles) of variable design and number. In the Chimpanzee, those crenations are

not quite as numerous and marked, while in the Gorilla, they are absent.

3. The incisors vary in position. Thus, in the Gibbon, they assume almost a vertical position; in the Orang there is a marked curve from root apex to incisal edge, tending to exaggerations; in the Chimpanzee this condition is less evident, while in the Gorilla the teeth are almost straight in their long axis and are prognathous.
4. The occlusion of the incisors of the anthropoids, as in the lower orders of mammals, is expressed either in an edge-to-edge or overbite relation.
5. The canines vary in form from the sabre-like structure of the Gibbon to the tusk-like appearance in the Gorilla.
6. They also vary in position in that there is a certain amount of rotation on their long axis observable as in the position of the canine in the Gibbon as compared with that of the other apes. Thus, in the Gibbon the mesial surface of the upper is everted, while that of the lower is inverted. Passing on to the Orang, this condition is modified to such an extent as to produce an inversion between the two extremes. The occlusion of the canines is that as associated with a raptorial type of tooth.
7. The premolars are bicuspid in all the apes in the upper jaw, while in the lower the first is sectorial and the second moliform.
8. Their position in the upper jaw is vertical. In the lower the first premolar assumes the diagonal position associated with sectorial teeth, while the second follows the position of the molars. Their occlusion is of the interlocking type.
9. The molars are quadritubercular in the upper jaw, a modification of the tuberculo-sectorial in the lower. They retain the primitive trigon to which the hypocone is added in the upper and the oblique ridge connecting the protocone with the metacone is distinct, while in the lower the paraconid has been lost, though the rest of the primitive cusps on the trigonid and the talonid are retained. The cusps in the Gorilla are high and triangular, in the Chimpanzee nipple-shaped, in the Orang flat and little marked, in the Gibbon high and rounded. In form, the molars are rhomboidal above and elongate below, ranging from the rounded contour in the Gibbon and Orang to the angular type in the Gorilla. Their position and occlusion are of the primitive type, with the two distinctive characteristics prevalent. Namely, the protocone occluding into the fossa of the talonid and the hypocone into that of the trigonid.

The Relationship of Form to Position in Teeth

By Milo Hellman, New York.

Part II. Primitive and Modern Man.

5.—On the Form, Position and Occlusion of the Teeth of Primitive Man.

Seth K. Humphrey in "Mankind," says: "In his physical aspect, man, given anything like normal conditions, develops true to the image predetermined by inheritance, down to the last item in its anatomy. It is a remarkable fact that physical inheritance yields very little to any environmental influence, short of malnutrition, accident and disease—and these three are abnormal conditions. In the usual case, physical response to environment is fairly direct, measurable and understood. In this respect, man is on a level with the animal."

The most primitive records bearing on man, though failing to manifest his *gradual* evolution, contain sufficient evidence to link him with certain extinct ancestors as well as with some lower forms of living mammals such as the Anthropoid Apes. Not only that, but also like the Anthropoids by the retention of certain primitive features, man exhibits a relationship to the placental mammals in general.

The Heidelberg Man.

The earliest authentic records bearing on the dentition of man is known from a mandible (Fig. 21), discovered in the valley of the Neckar, about six miles from Heidelberg. The Heidelberg jaw is the oldest positively dated relic of most primitive human form. The stratum where it was found is about 79 feet below the earth's surface, and belongs to the Mid-Pleistocene epoch associated with wholly extinct mammalian fauna (Gregory). Owing to the locality in which it was found, this mandible is referred to as belonging to the Heidelberg Man. Although typically human, it presents quite primitive and generalized features. As may be observed, the mandible is extraordinarily massive and considerably longer than any human mandible of to-day. But despite this, the dental arch is not very much longer than that of many modern jaws. In the great vertical depth of the body, the breadth of the ramus, the form of the symphisial region, lacking the chin eminence, the absence of an "ape shelf," and the occurrence of merely a moderate amount of bony tissue encroaching upon the anterior part of the tongue space.

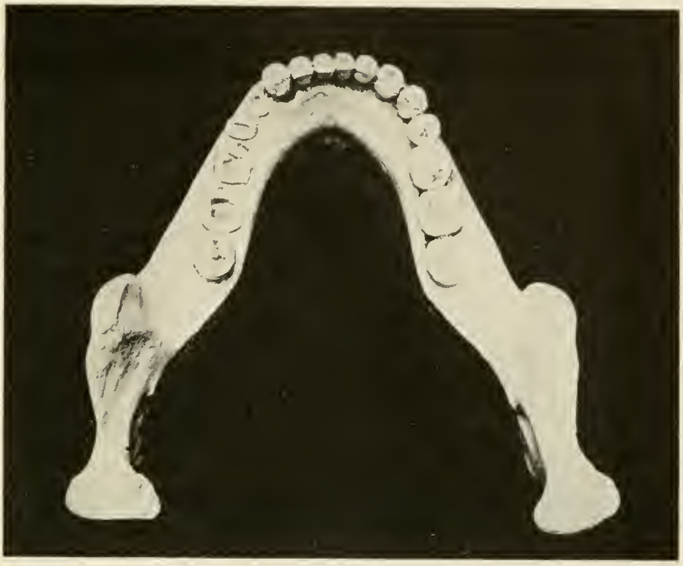

Fig. 21.

Fig. 21.—Mandible of *Homo Heidelbergensis.* Occlusal aspect, showing an oval curve in the anterior portion of the dental arch.

The teeth, though retaining many ancestral features, are typically human, and no larger than those to be found in some of the modern Australian skulls. The incisors are vertical in position, and from the evidence of wear must have met their antagonists in an edge-to-edge bite. The canines are stout and do not project above the occlusal plane of the incisors. The first premolar, though having lost the sectorial form and considerably reduced in size, is still found in an homologous position to that of the anthropoids. The second premolar in contradistinction to that of the anthropoids is larger than the first. Both premolars are rather prominent in the conformation of the anterior part of the dental arch. The incisors, canines and premolars are arranged in an oval curve, so to speak, whereas in modern man they are described as being set in an elliptic or parabolic curve. In consequence of this anterior arch-form, the canines appear to be associated in position with the incisors instead of indicating the boundary line between them and the premolar-molar series. As may be noticed in Fig. 21, the labio-lingual axis of the canine is more in an antero-posterior direction in contradistinction to that of modern man where it is more oblique. The molars are stout, and subequal in size, but present the primitive completement of cusps with the exception of the paraconid which, as in the anthropoids, is lost. Their transverse (bucco-lingual) diameter is less than in many modern molars.

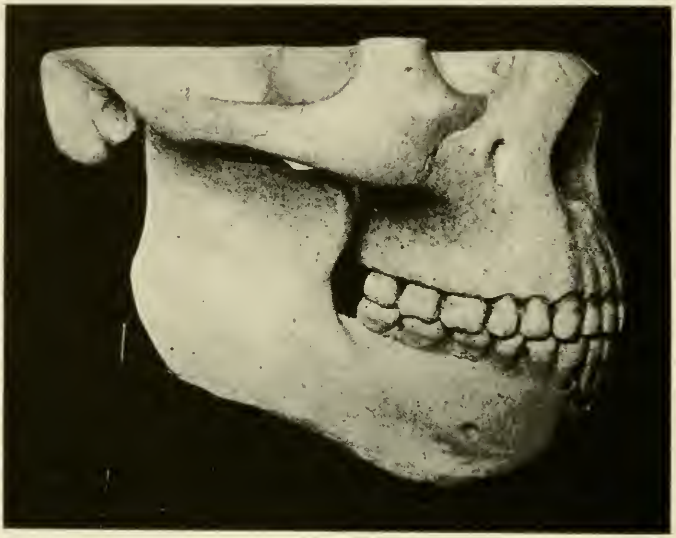

Fig. 22.

Fig. 22.—Restoration of the upper jaw and dental arch by Prof. J. H. McGregor, showing the teeth in occlusion with those in the lower jaw of Heidelberg Man. (From casts made by Prof. McGregor).

The distinctively human features are the vertical incisors, the stump-like canine, the proportions of the premolars and the pattern and arrangement of the molars. The conspicuous, even wear of all the teeth causes them to resemble those of more recent Man, in whom the teeth are worn by the mastication of foods prepared from cereals ground between gritty mill-stones and according to Todd, suggests the probability that the Heidelberg Man was already in the habit of masticating certain food products, prepared from crude flour. Whether all human beings belonging to that period possessed the characteristics described cannot be claimed, as the Heidelberg jaw is the only survivor of that race. The interest attached to the remains of this extinct individual has served as an incentive to many scientists for various speculations regarding the probable form of the features associated with the face and skull. Guided by a thorough knowledge of the characteristics of the various races of primitive man, J. H. MacGregor, Professor of Zoology, Columbia University, N. Y. City, made a restoration supplying the parts above the mandible. Fig 22 portrays the cast of the original lower jaw in occlusion with the restored upper jaw and teeth. The primitive, as well as the retentive characters present in the dentition of the anthropoids and man, are manifested in the form and position of the various teeth in the form of the restored upper dental arch. It needs no special mention to realize that more than a superficial knowledge of occlusion is necessary to perfect such a restoration.

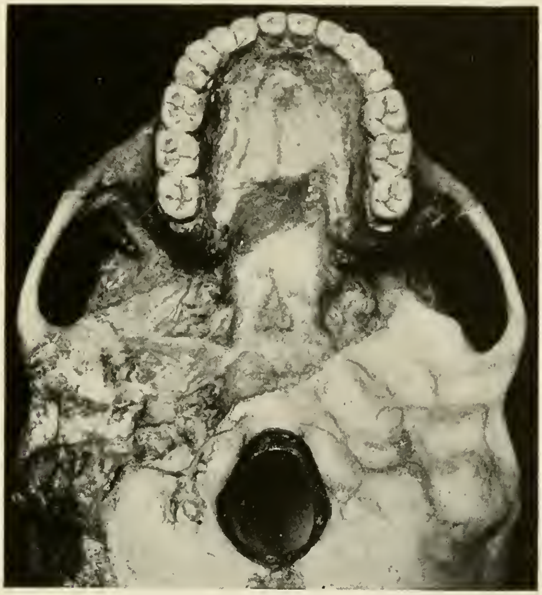

Fig. 23.

Fig. 23.—Dentition of the Gibraltar Skull. Occlusal view, showing restorations by Prof. McGregor of incisor and molar teeth.

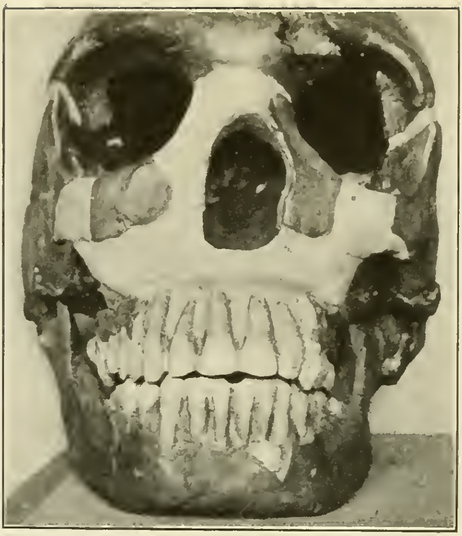

FIG. 24A.

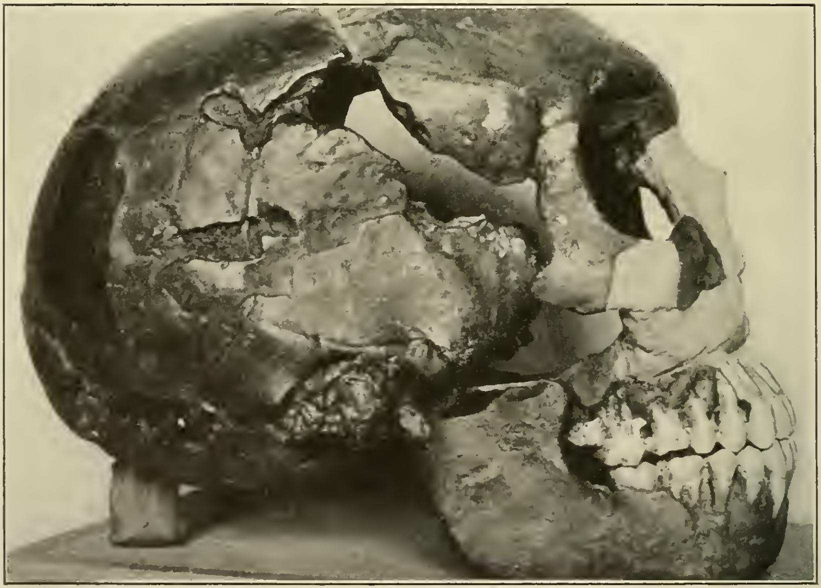

FIG. 24B.

FIG. 24.—Dentition of *Homo Mousteriensis*. A.—Front view, showing edge-to-edge bite. FIG. 24B.—Right side view, showing occlusion close to normal

The Gibraltar Skull.

The Gibraltar Skull is thought to be that of a female. It was discovered in 1848 at Gibraltar. This was the first member of the Neanderthal race discovered in Europe. The restorations were also made by Professor MacGregor. These, as well as the other cast, are on exhibition at the American Museum of Natural History in New York City.

In the Gibraltar Skull, the original fossil remains, the alveolar arch is quite well retained. The restorations made (Fig. 23) were limited to the incisors and the molars. But owing to the existing alveolar process and the remaining teeth, the task of making a correct restoration was not extremely difficult, though it entailed great care as to the accuracy of the prevailing primitive conditions. Thus, the molars are rhomboid in form, and are set in a primitive position as regards their antero-posterior axis. The form of the premolar cannot be described because they have not been thoroughly freed from the mineral deposits which, as may be seen, obliterate their contour. Their position, as that of the premolars in the Heidelberg lower dental arch, is in alignment with the flat oval curve extending from the anterior (or mesial) surface of the first molar of one side to that of the homologous molar on the other side. The first premolar is, therefore, considerably more lingual than the second in the Gibraltar skull, and more so than it is in later races of modern man. The canines, again, instead of constituting the terminals of the incisor arch, which is rather flat or shallow, are included in it. The form of the entire upper dental arch is such as to come quite near the pyriform arch of the orang.*

Two contemporary races made their appearance in Europe during the latter part of the Pleistocene (Glacial) epoch. One was the Mousterian, a Neanderthaloid race, the other the Aurignacian, which, according to some authorities, is the forerunner of modern man.

Homo Mousteriensis

The remains of Homo Mousteriensis include a fairly complete skull with almost perfect dental arches. It is the skull of a youth (Fig. 24, A, B, C, D, E) with considerably large teeth. The upper central incisors for instance are 11 mm. mesio-distally and 8 mm. labio-lingually; the upper first molar 11.7 mm. by 12 mm. In form, the teeth, with the exception of the lower second premolar and upper third molar do not vary to any great extent from those of modern man, though in size they differ considerably.

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* See "Observations on the Form of the Dental Arch in the Orang," International Journal of Orthodontia, Vol. IV, No. 2, February, 1918.

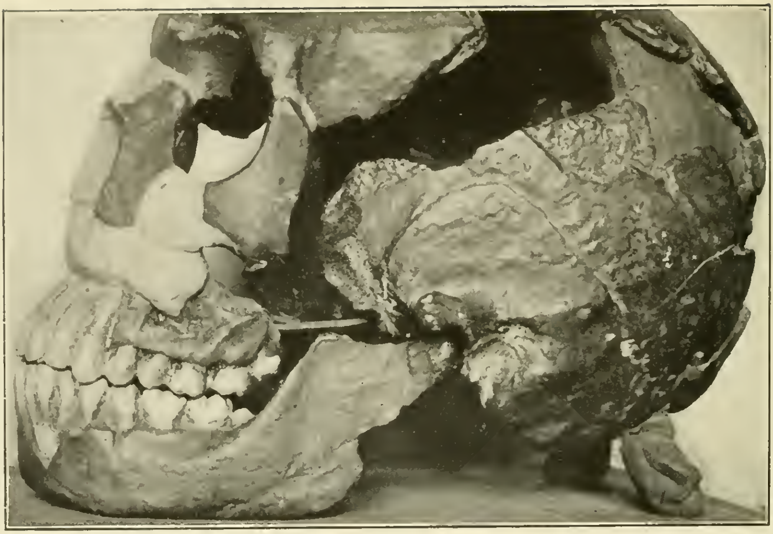
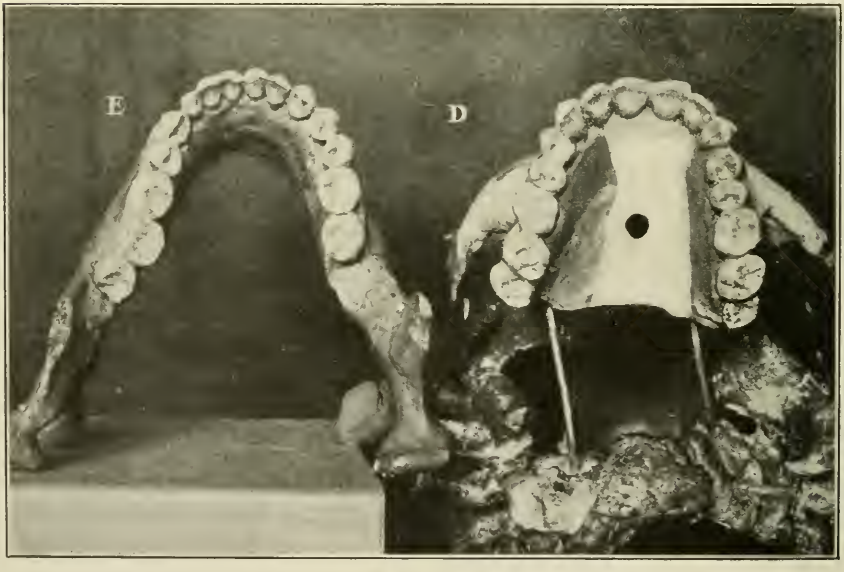


Fig. 24C.

Fig. 24C.—Left side, showing similar conditions as B, the teeth being prevented from coming into apposition by warping in the condyle region of the lower jaw.



Figs. 24 D and E.

Fig. 24D, E.—Occlusal view of upper D, and lower E, showing the difference in position of upper and lower canines and molars. (J. Leon Williams collection, Am. Mus. of Nat. Hist.)

The lower second premolar is considerably molariform, possessing four cusps, the disto-lingual cusp of the modern tricuspid tooth divided into two. The lower molars all have the hypoconulid and are therefore five-cusped; the paraconid being lost, they are all of equal size. The upper third molars possess a decided hypocone as do the first and second molars in addition to which the first also has a hypoconule. It may also be stated that the upper incisors are rather flat labio-lingually, as compared with their mesio-distal diameter at the incisal edge. The position of the incisors, as well as the inclination of the alveolar process in that region, is rather orthognathous, approaching more modern man than that of the *Neolithic*. Their occlusion is that of a very slight overbite relation, as may be observed by the facettes on the upper central incisors.

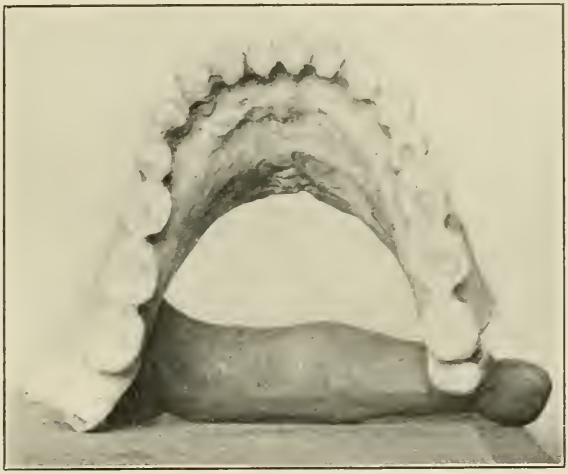


Fig. 25.

Fig. 25.—Lower jaw of Neanderthaloid individual. Occlusal view, showing primitive position of canines and conformation of lower arch. (Am. Mus. of Nat. Hist.).

The canines, while resembling those in modern man completely in form and position in the upper jaw, remain primitive in position in the lower jaw. The labio-lingual axis in the lower is directed more antero-posteriorly than in the Aurignacian or Modern Man. See Fig. 24 E. The left canine is still the deciduous member. Another point of interest may be seen in the impacted left permanent canine, Fig. 24, A.

The premolars are bicuspid in the upper and bicuspid (the first) and quadri-cuspid (second) in the lower. Their occlusion, of course, is of the interlocking type.

The molars in the upper jaw are rhomboid in form, rounded in contour and retain the primitive trigone and hypocone. In the lower series, they are of the Dryopithecus modification of the tuberculo-sectorial type of molar, having lost the paraconid though retaining the hypoconulid. In position, the upper exhibit their primitive character, while in the lower the buccal cusps are more evenly aligned. The occlusion is of the primitive type, i. e., the protocone fitting into the talonid fossa and the hypocone into that of the trigonid. Owing, however, to a slight warping in the condyle region which probably occurred in the process of fossilization, the lower jaw cannot be accurately adjusted in occlusion. (See Fig. 24, B. C).

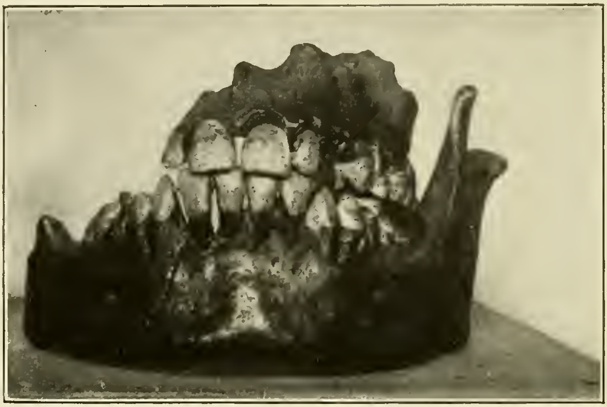


Fig. 26.

Fig. 26.—Dentition of a *Neolithic* young individual, showing form and position of upper left lateral incisor. (Am. Mus. of Nat. Hist.).

Another point of interest in conjunction with this specimen is attached to the difference in form of the upper dental arch as compared with that of the lower. On reflection, it may be recalled that in the anthropoids, such association appears in a large number of cases. Owing to the difference in the character and nature of the teeth in the two jaws, it must be quite obvious that there should be a difference in the form of the arch to conform to the difference in position of the canines and the deflection into opposite directions of the antero-posterior axis of the molars in the two jaws.

Another specimen (Fig. 25) of the same race, of a considerably older individual as indicated by worn surface of all the teeth, shows the same relative position of the canines on both sides and the form of the lower dental arch in the incisor, canine and premolar region. Judging by the facettes on the incisors and canines one may be led to the conclusion that these teeth were in edge-to-edge relation.

Fig. 26 represents the entire lower and one-half of the upper jaw of a very young individual of *Neolithic* time, as may be seen by the presence of some deciduous molars, the absence of the upper canine and the erupting lower canines and first premolars. The point of greatest interest connected with this specimen is the form and position of the upper lateral incisors. This is the oldest representative of man known to me to possess this form of lateral incisor and occupying the lapping position indicated. As will be seen later, this characteristic position may be due to morphogenetic conditions and is prevalent in many races in modern man.

The Deciduous Teeth of Modern Man.

Before taking up the dentition of modern man, it will be profitable to pause for a moment and consider several features associated with the human deciduous teeth. Although exhibiting generalized characters, the deciduous teeth of man form another link in the chain of evidence establishing the bond between lower animals and *Homo Sapiens*. Thus, there are several features in the human deciduous dentition that present primitive characters that closely resemble similar manifestations in the homologous series of the ape. In the deciduous teeth of man, the following points are of interest:

1. The incisors closely resemble those of the Gibbon in size, form and position. The only exception is the lack of the accentuated palatal cingulum in the upper incisors and lower canine in man. In both ape and man they are vertical in position and meet in an edge-to-edge or overbite occlusion. The occlusion of the incisors is significant in relation to the development of their permanent successors and the antero-posterior relationship of the jaws. In order that this relationship should not be disturbed during the period of development of the permanent incisors, two manifestations become evident. The deciduous incisors become spaced considerably if they are in an overbite relationship, or they remain less spaced if they assume the edge-to-edge occlusion. If either of these conditions is not fulfilled, due to disturbances not encompassed within the scope of this paper, there will result one of the various anomalies in occlusion of the permanent teeth. Thus, there may ensue:

a. A change in the antero-posterior relation of the two jaws, with or without complications in the antemolar region, or,

b. No change in the antero-posterior relation of the jaws will occur, but complications may arise in the antemolar region.

Furthermore, the lack of spacing in the incisor region is only diagnostic of certain morphogenetic processes that become manifest in the permanent dental series. Thus, the permanent upper lateral incisors during their development before eruption occupy one of two positions. Either they lap the distal end of the crowns of the central incisor with their mesial crown portion, or *vice versa,* they are lapped over their mesial portion by that of the distal of the central incisors. In either case there are certain features brought about in the form and position of the lateral incisor that reveal this condition when they subsequently take their position in the dental arch.

2. The canines are globular in contour and resemble the incisors of several species of carnivora, though being larger in form. The occlusion, simulating that of the incisors, is either in edge-to-edge or overbite relation.
3. The molars differ in form and position in the two jaws and from one another in each jaw. Thus, the upper first molar, though being bicuspid in form, presents such sharp mesial and distal marginal ridges in connection with the cusps as to render the form of the cusps more like those of the permanent canines with cutting edges, the buccal cusp being separated from the lingual by a deep angular groove. In some instances there is a vestigial metacone present. The lower first molar on the other hand exhibits decided primitive features. It is tuberculo-sectorial in character, exhibiting a vestige of the protoconid-paraconid shear in the structure represented by the mesial marginal ridge, the buccal slope with the exaggerated gingival swelling resembling that of the first premolar in the anthropoids against which the large upper canine exerts its greatest functional activity. The metaconid is more distally placed than in the second molar or than in all of the permanent molars, and resembles that of the anthropoids. The posterior moiety shows the talonid with its basin-like depression for the accommodation of the lingual cusp of the upper bicuspidate first molar. The other cusps on the talonid are the hypoconid, entoconid and a vestigial hypoconulid. In position this tooth resembles the sectorial, being obliquely set with the mesial surface antero-internally.

The second molars, both upper and lower, resemble exactly the first permanent molars in form, though being smaller in size, and their occlusal surfaces are more constricted as compared with those of the permanent teeth. The ridges and grooves are not as well defined, and the enamel is more irregularly deposited than in the permanent teeth. The upper second molars retain the primitive trigon to which the hypocone is added. The lower as in the apes has lost the paraconid, but retains all the other primitive cusps. The occlusion is of the primitive type, the protocone fitting into the talonid basin. Owing, however, to a slight rotation of the upper second deciduous molar appearing in a large number of cases in modern races, the primitive position of this tooth, involving its everted mesio-distal axis, seems to be changed and the molars are described as occluding cusp-to-cusp. If the palatal cusps, however, be examined, it will be found that the primitive relationship is maintained despite the buccal manifestations.

6.—On the Form, Position and Occlusion of the Teeth of Modern Man.

In the lapse of time from Heidelberg Man until now (about 250,000 years), there has been a considerable increase in number of individuals constituting the human family. The records, therefore, of modern man must necessarily embrace vast numbers of specimens. To approach anything like a complete study of modern man, presents, consequently, a problem of enormous proportions. Since it would be out of the question for one in the practice to devote sufficient time to such an undertaking, it is necessary to limit such desires in accordance with the odd moments available for study.

The material examined was obtained at the American Museum of Natural History of New York, and at the U. S. National Museum at Washington, D. C. It comprises the skulls of American Indians, Mongolians, Eskimos, natives of Asiatic South India and some European Whites in the following proportions:

American Indians	U. S. Museum,	649	
	Amer. "	2719	3368
Mongolians	U. S. Museum		207
Eskimos	U. S. Museum,	173	
	Amer. "	14	187
European White (Spain)	Amer. Museum		6
Asia, So. India	Amer. Museum		8
In all			3776

From the quantity of this material only those skulls presenting the best and most complete dentures in what is understood as "normal" or nearest to "normal" in occlusion were selected for careful examination and study.

The primitive characters observed in connection with the form, position and occlusion of the teeth in the other groups of animals are also manifested in those of modern man. Moreover, these characters are *fundamental* and may be interpreted as being of evolutional significance and exhibiting racial peculiarities.

It is, therefore, necessary to treat this portion of our topic from the aspect of first, *the general features common to all the dentitons examined; and second,* those of *divergent peculiarities.*

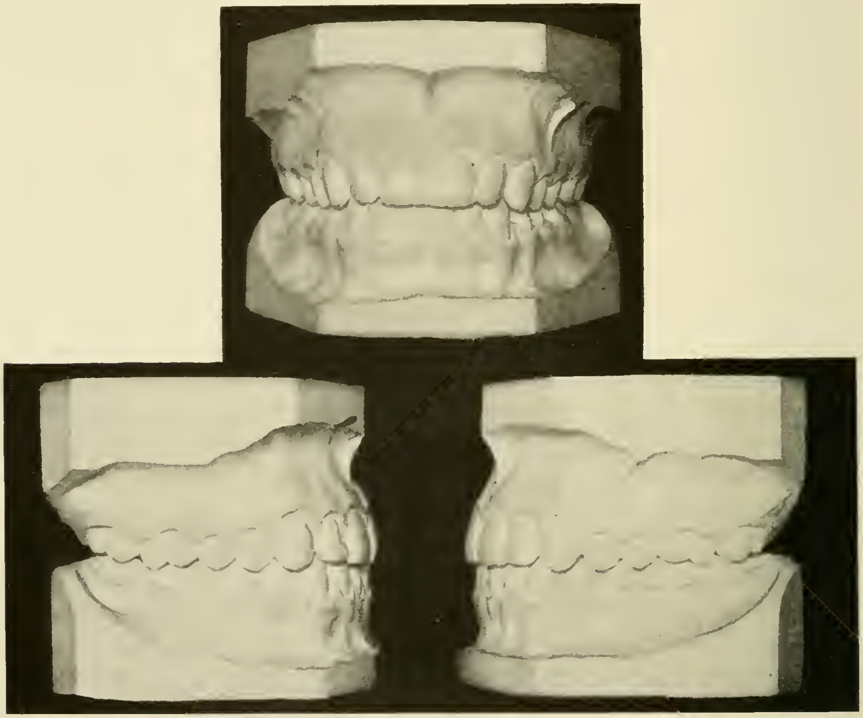


Fig. 27 A, B, and C.

Fig. 27.—Casts of Dentition of modern white female. A.—Anterior view, showing position of convex lateral incisors and normal overbite. B, C.—Right and left sides, showing normal occlusion of premolar-molar series, convex laterals lapping the distal portion of the central incisor.

The Aspect of the General Features Common to the Dentitions Examined.

Under this heading the form and position of all the teeth in modern man may be included. The incisors, for instance, having acquired the human form with which you are all well acquainted, vary little in general. In contour, they may vary in different races and in certain individuals of the same race. Thus, the mesio-distal labial aspect of the crown in the upper incisors may appear as a flat surface in one instance, as in many Indians and Eskimos and in others they may be decidedly convex. The lingual surface on the other hand may vary from a simple plane to a decided concavity. This form is found to be associated with the horizontal position of those teeth. Thus, the flat centrals in the Indian is found usually everted at the distal angle, while the extreme convex laterals are found lapping the centrals in other races as in the *Neolithic*. In their long axis the incisors may present a straight line from root apex to crown edge, or a considerable curve approaching somewhat that in the orang incisors; or, they may present a double curve, concave labially in the root region and convex in the crown. In position they are all vertical, though varying in degree of inclination in different races and in the individuals of each race. In occlusion they are either in an edge-to-edge or an overbite relation.

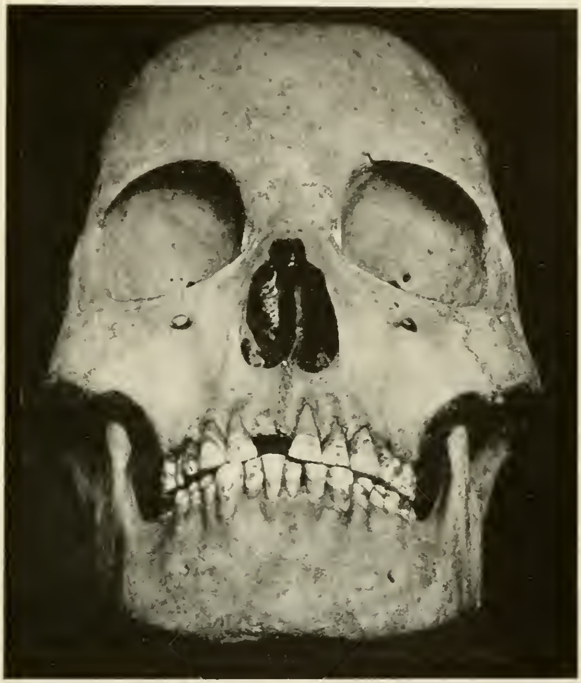


Fig. 28A.

Fig. 28.—Dentition of Eskimo A.—Front view, showing flat type of incisors in edge-to-edge occlusion.

The proportionate difference in dimension between the upper centrals and laterals is not as marked in man as in the anthropoids. Though the lateral incisors vary considerably in form and position, they may be identified by two distinctive manifestations. In the one, the labial surface is considerably convex mesio-distally, quite narrow at the neck, and its incisal edge is very much pointed at the mesio-incisal angle; while the

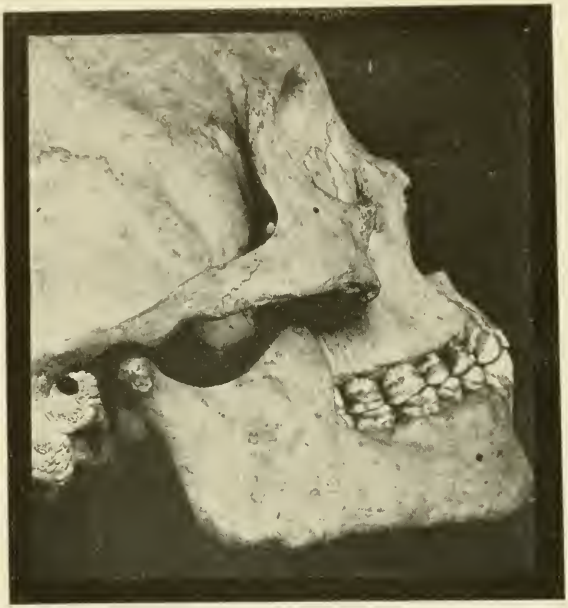


Fig. 28B.

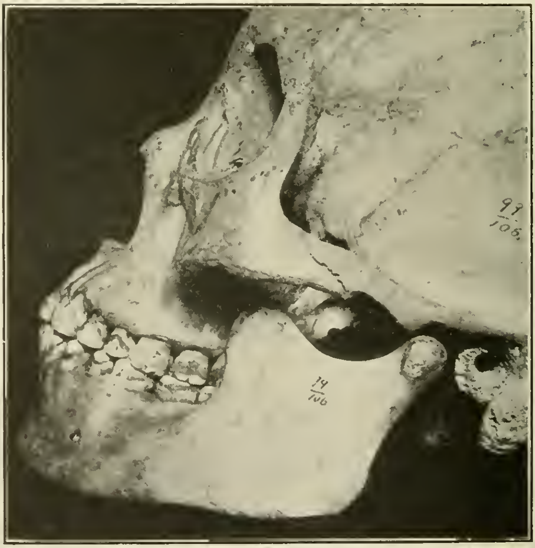


Fig. 28C.

Fig. 28 B, C.—Right and left sides, showing normal occlusion of premolar-molar series and the lingual tendency of lateral incisors.

distal incisal angle is very obtuse, presenting an aspect as though the entire crown is curved with the concavity on the mesial. The position of a lateral incisor of this description is invariably such as to permit the mesio-lingual angle to lap the disto-labial of the central incisor. Fig. 27, A, B, C.

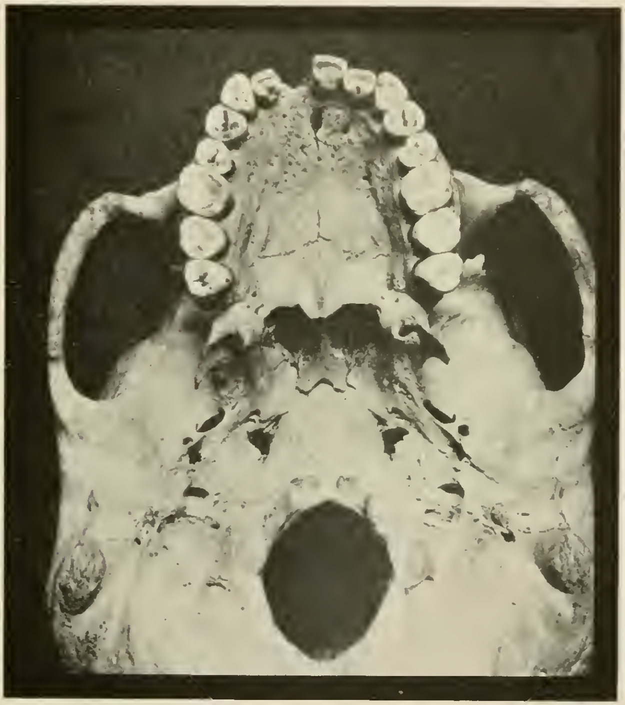


Fig. 28D.

Fig. 28D.—Occlusal view of upper dental arch, showing tendency of central incisor to lap the lateral, primitive position of molars.

In the other instances, the lateral incisor presents a flat labial and lingual surface. Very often a vertical shallow groove may be seen on the labial surface. Such laterals invariably do not lap the centrals, but may in some instances be slightly lapped by the centrals, as in the Eskimo dentitions (Fig. 28, A, B, C, D, E), also Fig. 1, D, shows similar characteristics. These two distinctions are strongly indicative of conditions anteceding the crown eruption of the laterals and are suggestive of unalterable developmental modifications in form. Whether such modifications are merely chance variations or produced by some dominating force remains as yet to be determined; certain it is, that the position of the laterals is closely associated with their form.

The lower incisors present less modifications in form as well as a less difference in proportions between the centrals and laterals. In position it may be noticed that the lower incisors are very rarely evenly aligned when the upper incisors are in exact proximate contact. This is true of all dentitions examined. The only exception noticed to this general observation is manifested when the upper incisors are spaced.

The canine of modern man as that in our primitive ancestor is not materially changed in form, from that in the earliest forerunner of the primate order, *Parapithecus*. Unlike the canine in the lower apes and anthropoids, it remains a more generalized organ, while in the other primate families, this tooth has become specialized in adaptation for certain functions. Man, through the progressive evolution of his brain, developed the use of his hands, and with the aid of certain implements the canine functions of the anthropoids for grasping, tearing, cutting and fighting are substituted. It is, therefore, not improbable that man may never have had large canine teeth resembling those of the apes, but rather may have developed along lines with small canines, but with intelligent brain and skillful hands.

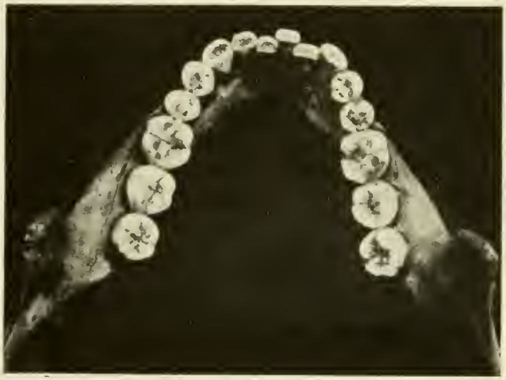


FIG. 28E.

FIG. 28E.—Occlusal view of the lower dental arch, showing lapping of incisors and primitive position of canines.

In position, the canine of modern man varies only in degree from that attained in the Heidelberg Man, and not at all from the Neanderthal. In the upper jaw, its mesio-distal axis is so placed as to produce a continuity in the curve of the incisors and that of the premolar-molar series, in contradistinction to the anthropoids, where in position they partake of the arrangement in the alignment of the premolar-molar series alone. Although the Heidelberg and Gibraltar dentitions show a decided deviation from the ape mode of tooth arrangement, it is in the Neanderthal race that the position of the canine which we retain to this day is definitely established.

The lower canine, though somewhat reduced in dimensions from that of the ancestral predecessor, retains its primitive position with most accurate precision. It is a most curious fact, but nevertheless true, that the lower canine as well as the post canine lower teeth in modern man are found to follow quite closely the positions of the homologous teeth in primitive man. Thus, its labio-lingual axis quite frequently is directed antero-posteriorly, and it still persists in associating itself with the incisor alignment, in contrast to the upper canine tendency.

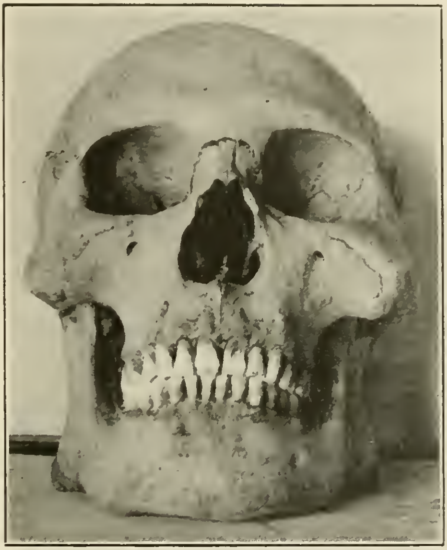


Fig. 29A.

Fig. 29.—Mongolian Dentition. A.—Anterior view, showing normal occlusion with considerable overbite in the incisor region.

The premolars are extremely erratic in size, form and position. In size they vary considerably in different races, in the individuals of each race and in the different teeth in the same dentition. Thus, usually the first upper premolars are larger than the second, and *vice versa* in the lower jaw. But the exceptions to this rule are so numerous as to cause confusion as to the rule and the exception. In form they are bicuspidate in the upper jaw, and in the lower the first has a well developed buccal cusp and lingually it has an accentuated cingulum or a vestigial cusp. The second lower premolar is either bicuspid or tricuspid. The tricuspid lower premolar simulates the primitive tritubercular form of tooth, with the protoconid, paraconid and metaconid. And in occlusion, this tooth is representative of the interlocking type of occlusion, the three cusps like those in primitive forms fitting between the upper premolars, the lingual cusp of the upper second premolar occluding within the vestigal talonid basin formed by the distal marginal ridge distally and the buccal and disto-lingual cusp mesially. In position the premolars are also erratic. While the upper premolars, with some exceptions, assume their positions in conformity with the canine-molar outline, the lower premolars assume positions resembling more those in the Neanderthal dental arch. The reason for such irregularity in position may only be found in the explanation of a general tendency toward irregularity in the shedding of the deciduous molars and eruption of the premolars, probably causally related to evolutional processes. On the casual observation of this phenomenon, it has been found that in a large number of individuals with normal dentitions, these teeth exhibit such peculiarities. These peculiarities are also found to exist to a high degree in certain families.

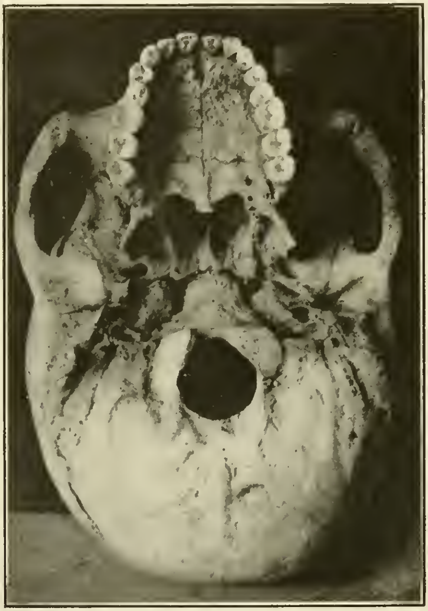


Fig. 29B.

Fig. 29B.—Occlusal view of upper dental arch, showing flat incisors, the centrals tending to lap the laterals, primitive position of the molars and difference in arch outline from that of the lower.

Inasmuch as evolution has produced a change in the number of the incisors and premolars altering the original placental mammalian dental formula of 3, 1, 4, 3 by the reduction of one incisor and two premolars, on each side of each jaw, it seems that its potency has not as yet been expended and is yet to be accounted for. The constant modification in form and position of the lateral incisors and the peculiarities associated with the premolars are undoubtedly most ominous phenomena regarding the fate of the future dental formula of Man in these particular regions.

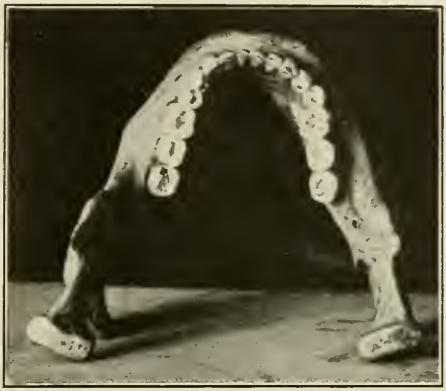


Fig. 29C.

Fig. 29C.—Occlusal aspect of the lower dental arch, showing lapping of incisors, primitive position of canines and difference in arch outline from that of the upper.

The molars all retain their primitive form with the exception of the lower second tooth. The upper molars still possess the primitive cusp formula identified with the trigon, while the first almost invariably has a hypocone; the second and third may have it at times well developed and at others vestigial in form or entirely lacking. The lower molars still retain the primate cusp formula, lacking, of course, the paraconid in all and the hypoconulid in the second molar of some races.

As regards their position, it may be said in a general way that the molars adhere to the primitive manner of aligning themselves in the dental arch. Thus, in the upper jaw, for instance, the mesio-distal axis is obliquely set to the outline of the dental arch; i. e., if a succession of lines be drawn parallel to the buccal surfaces of the upper molars, the anterior ends would be directed antero-externally. There may, however, be some slight variation to this position in the first molar only in certain instances, the second and third upper molars deviate very rarely from this position. And when they do, they approach more an anomalous manifestation.

In the lower jaw, the molars differ in position from those in the upper. The lower molars are arranged in such a manner as to place the buccal cusps in an evenly aligned series. It is only when the first upper molar deviates in the slightest manner from its primitive position that the lowest second molar will be slightly rotated mesio-buccally.

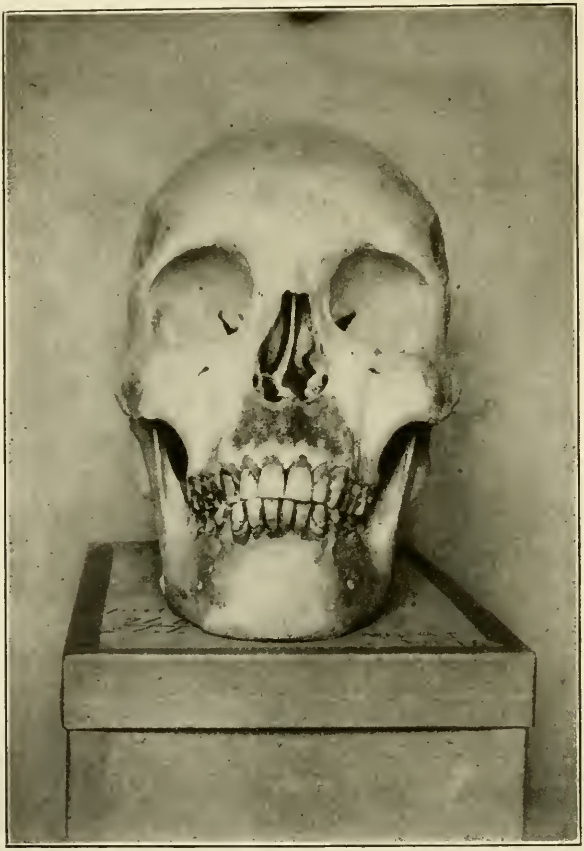


Fig. 30.

Fig. 30.—*Dentition of Hindoo.* A.—Anterior view, showing normal occlusion with slight overbite of incisor.

The occlusion in the dentition of modern man has retained its primitive features in toto. The molars, as in the primitive placental mammals, in the anthropoids and in primitive man still maintain the same relationship. The protocone still fitting into the talonid basin, and the hypocone into that of the trigonid. In the premolars, the primitive wedge-type of occlusion persists; in the incisor-canine region, the edge-to-edge and over bite relation is manifest. (See Fig. 14).

It must be emphasized at this point that the reason why the evolutionist and paleontologist designate the molar occlusion by the lingual cusps in the upper and the fossae in the lower molars, is first because the points constitute the most primitive form of molar occlusion, and is still preserved in all mammals possessing molar or premolar teeth. Secondly, because of the extensive modification of the buccal aspect of the premolar-molar series, from the primitive tritubercular type to the omnivorous type of tooth, the buccal cusps were always obscured by various structures associated with that region of the tooth. Thirdly, the various forms of structures developing on the buccal surface of the molar teeth have invariably played a secondary part, mainly as an aid to the main functional portions of the crown. Lastly, the primitive lingual cusps of the upper fitting into the fossae of the lower molars are associated with the primary functional activity, as they are the elements constituting the mortar and pestle efficiency necessary in grinding and triturating the various food substances comprised in animal diet.

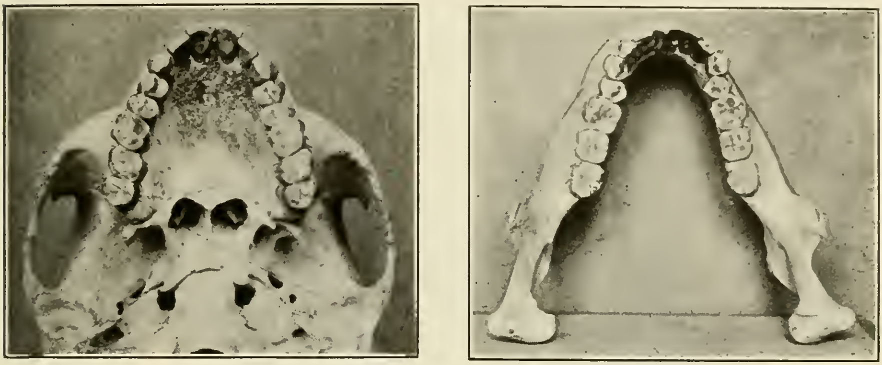


Fig. 30B.

Fig. 30C.

Fig. 30B—Occlusal view of upper dental arch, showing considerable difference in form from that in Fig. 29, and differing from its lower mate. 30C—Occlusal aspect of lower dental arch, showing difference in form from that of the upper.

It would seem of considerable importance that the orthodontists should adopt a similar plan of procedure, especially with regard to the classification of the occlusal anomalies. As has been suggested above, the buccal cusps are at times liable to misrepresent the true relationship of the molars. By a slight rotation of the molar on its long axis antero-internally, the buccal cusps assume a point to point or distal relationship (Class II, Angle), while the mesio-lingual cusp of the upper molar (protocone) has as yet not exceeded its divergence from the primitive, normal position to justify such a classification if it be based on functional significance. Another important, and to my mind fundamental, reason for following the scientists' distinctions rests with the following fact: In aligning the teeth to any conceived form of dental arch, as proposed by various methods and schemes of determining or predetermining it, the buccal cusps of the upper molars and the buccal grooves of the lower molars are usually taken into consideration to a greater extent than is necessary.

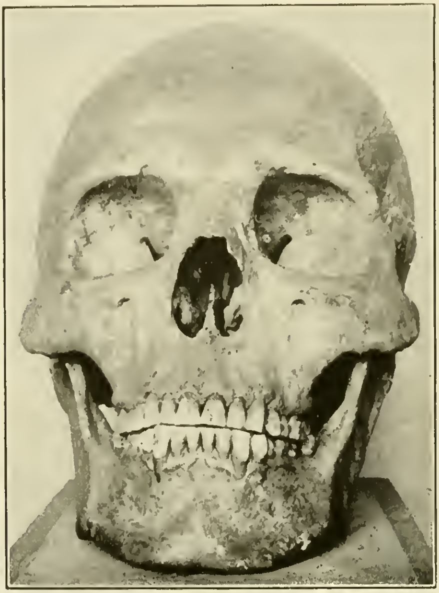


Fig. 31.

Fig. 31.—Dentition of American Indian, showing the prevailing edge-to-edge bite.

As has been shown, the buccal aspects of the upper molar, in the best dentitions exhibited are arranged in a manner that is not in accord with such schemes, but is in harmony, nevertheless, with the nature of the tooth and brought about by evolutional processes. As it is a primitive feature still retained in modern man, it should receive more care and consideration before the primitive position is altered.

As evidence of the erroneous idea involved in the arrangement of the buccal cusps in the upper molars according to a certain arch outline it may be observed that in almost all Class II cases of malocclusion, the molars as a rule are diverted from the primitive direction of the mesio-distal axis.

Instead of the anterior direction being everted as under normal conditions it is inverted. And one of the most important steps to be taken in all Class II cases is to restore the upper molar to its primitive position. And where the protocone has not exceeded the limits of its ancestral relation, the apparently "distal occlusion" will readily be remedied without any other means. The assumption is, therefore, unavoidable that in a proper classification of cases, as well as in their correct treatment, the lingual cusps of the upper molars are of greatest importance. And if in the various dental arch designs, this feature would be taken into consideration, they would be of more value than has hitherto been the case.

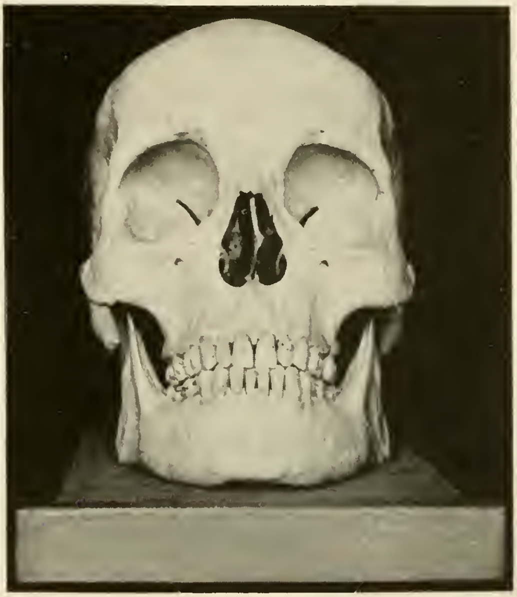


FIG. 32.

FIG. 32.—Dentition of European White, showing the prevailing overbite.

In the lower jaw, the buccal cusps assume an homologous significance to that of the lingual cusps in the upper. However, what is of importance, and must not be left out of sight at any time from the classification of a case to the completion of treatment, are the primitive points of occlusion, and if they be restored in anomalous cases as they are retained under normal conditions, not overlooking, of course, the primitive position characteristic of those teeth, the alignment of the buccal cusps of the upper, like that of the lingual cusps of the lower molars, will take care of itself.

Divergent Peculiarities.

The divergent peculiarities observed in relation to the dentitions examined, are manifested mainly in the form of the dental arches and in the manner of incisor occlusion, a characteristic of certain races. As the problem of the dental arch form has been dealt with on a previous occasion, it will suffice at present to demonstrate, in passing, such peculiarities in form as is existent in the three different races, the Mongolian, the Eskimo and the Hindoo, Figs. 28, 29, 30. Note the general outline of the upper dental arch, as compared with the lower, and note also the position of the canines in the different arch forms.

The other diversity refers to the incisor occlusion. Thus, it is a well established fact that in primitive man, as seen in *Homo Heidelbergensis* and *Homo Neanderthalensis,* the incisor occlusion was in edge-to-edge relation. This form of incisor occlusion seems to have been the prevailing type, until a quite recent period of geologic time. As Keith points out, "in Anglo-Saxon time almost the entire population possessed an edge-to-edge bite. After the lapse of less than a thousand years ninety-five per cent. of the modern Englishmen possess an overbite." In the skulls examined the American Indians (Fig. 31) exhibit an edge-to-edge bite exclusively, as do also the Eskimos. The European white (Fig. 32) and the natives of Asiatic South India (Fig. 30) present an overbite, the extreme of which is reached in the Mongolians (Fig. 29). Of course, the number of skulls of the Hindoo and the White was so small that nothing of a definite opinion could be formed. But I am informed by Dr. Weinberger that the examination of the teeth of the white males here during the recruiting activity revealed the fact that the edge-to-edge bite was prevalent in a high percentage of cases in the adults of military age examined for U. S. service.

Crystallizing the main ideas implied in the remarks made on this topic, the following conclusions cannot be avoided:

1. That hitherto the conception of "Normal Occluson" was based upon an ideal insufficiently supported by concrete evidence.

2. That investigations of extensive collections of anatomic material reveal the fact that the best dentitions do not correspond to the conceived abstract ideal.

3. That interpretations based upon this fact must necessarily imply a conception of the normal as encompassed within a border-line of such proportions that will permit of modifications in detail *without a change in type.*

4. That this border-line which permits of some modification in *individual manifestations* is what is termed the *territory of normal varia-*

tion, and it belongs to the type by the right of frequency as does the "ideal" by the right of *perfection.* For instance, because "Sandow" represents the ideal in strength and physical development, it does not prove that all those not corresponding to such criterion as represented by him will be *abnormal.* It is the standard adhered to by the greatest number of individuals free from disease, weakness or deformity that decides the question of type or that of normality, and not the individual personifying an ideal that may have been artificially developed by intensive and careful training. He may be more rightfully considered the extreme.

5. That the illustrations, moreover, reveal the fact that although they present dentitions *considerably* superior to the average, they may not correspond with the *generally conceived ideal of the orthodontist.* It must, however, be conceded that they represent a normal type, *the human type of dentition,* and that this was developed along evolutional lines as may be proved by the primitive features still retained.

6. That these primitive features, embracing as they do such characters as number, form, position and occlusion of the teeth, must be of greater significance to the orthodontist than hitherto realized.

7. That since the orthodontist is mainly concerned with changes in *position* of teeth and their effect upon occlusion, it is of paramount importance for him to have a keen appreciation of the results obtained by nature in her ceaseless efforts during vast periods of time, as well as the means employed by her in retaining those modifications in the infinite variety of functional adaptations as revealed to us.

8. That since it is beyond the possibility of orthodontia to exert the slightest influence toward the modification of a tooth in its form, and since the tooth-form has retained most of its primitive features, it is imperative to base the modification in its position in accordance with these *ancestral characters,* following the plan as laid down by evolutional records. For, unless these conditions are fulfilled first, there will always be a tendency on the part of nature to assert herself by a modification of all orthodontic procedures not in accord with her dictates. If we would, therefore, work *with* nature and have her approval and assistance, we must confine our efforts in a more strenuous endeavor to learn to understand her, accept and appreciate her guidance by the recognition of her laws as laid down in the form of all *primitive characters* and their various modifications as found to be associated with the dentition of man.

It is with considerable gratification that I acknowledge the valuable information obtained from the works mentioned below for the preparation of this paper. I also am greatly indebted to Dr. Wm. K. Gregory of the Museum of Natural History for his help, advice and judgment in the selection of extensive material for study.

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Discussion on Dr. Hellman's Paper.

Dr. Martin Dewey, Chicago.

In discussing this paper I shall confine my remarks very largely to that feature which concerns the shape of the tooth as a type in arch form.

Etiological Factors in Arch Form.

Various attempts have been made to arrive at some standard form of arch, especially for the human mouth, but all of these attempts have failed to take into consideration the various factors that should be carefully weighed. It must be remembered that man is only one small part of the animal kingdom, and any law regarding his development must also be workable, or have a bearing upon the lower animal. As Dr. Johnson told you yesterday, orthodontia can be defined as a study of the forces which are largely concerned in normal occlusion. I may not quote him correctly, but his idea is that orthodontia takes in more than malocclusion.

In considering arch forms we must take into consideration all the forces that are responsible for the formation of that arch. We find there is a certain relation between the shape of the teeth and the use to which that tooth is put. There is a certain relation between form and function. Furthermore, there is a certain relation between the cusps and the approximal contact point which has an influence upon the shape of the arch, and it not only has an influence upon the shape of the arch, but on those structures which support the arch; or we can go further than that and say that given cusps of a certain size or shape, we must have a contact point of certain shape or size, which impels a certain shape for the mandible and maxilla. Having a mandible and maxilla of a certain shape, you need a temporo-mandibular articulation in keeping with the form of them.

A few years ago an attempt was made by some British investigators to play a joke on Sir Richard Owen, who was curator of the British Museum for a number of years, and a man wo probably knows more about teeth than any other living man. He took the position that the tooth was the most important part of the animal economy; that if he had one tooth he could build a complete animal from that one tooth. The British government sent an expedition to Africa, and they discovered a large number of fossils with more teeth than anything else. One of the fossils they had discovered complete, and they gave Sir Richard Owen one tooth. He took that tooth, not knowing the nature of the animal, what it was, what it looked like, what kind of skull it had, and gave a complete description of the fossil before he saw it. You can do that with modern animals. You can take any species and take one tooth of the animal and practically build up the entire dentition, so far as the cusps, contact points, temporo-mandibular articulation, mandible and jaws are concerned. But you must take all these things into consideration and realize that each one has a bearing upon the other, and by having one link of the chain, you can build up the rest. This simply shows the influence which form and function have, or how they operate together.

I will show you slides of a few skulls to demonstrate the importance of cusps and approximal contact, and to illustrate the shape or size of one particular tooth which will change the entire dental arch. (Dr. Dewey then delivered a most interesting talk illustrated with lantern slides.)

Dr. Frederick C. Kemple, New York City.

I do not know why Dr. Hellman asked me to discuss this paper, unless he wanted to bring the discussion down to words of one syllable.

I shall not attempt to discuss the variations in structure, form or arrangement of the human teeth. We all know there is considerable variation in all these. That the teeth on one side of the mouth may differ considerably in size and shape from those on the opposite side of the same mouth, and that the teeth of the lower arch seldom harmonize perfectly in size and form with those of the upper arch: that no two mouths are alike any more than two faces are exactly alike.

These natural variations and lack of symmetry produce wide differences in what may be called practical normal occlusion. The incisal contact may vary from an end-to-end bite to an overbite that is very deep; and the inharmony in size of the teeth in the two arches may result in the incisors being either slightly spaced or slightly crowded, and yet, the occlusion would be normal for the individual. In other words, there is in most cases a very great difference between *normal occlusion* and *ideal occlusion.* Dr. Hellman showed in his charts yesterday the wide difference in arch forms and occlusion that he has found to exist in the same species of the lower placental mammals. And it was the fact that *normal occlusion* may not be, and usually is not, *ideal occlusion* that prompted Dr. Johnson to write his paper on the subject, "The Individual Normal the Problem of Orthodontia.' '

Dr. Angle evidently accepted this same fact when in one of the early editions of his work on "Malocclusion," he said, in substance, "that in treating malocclusion the operator could only hope to place the teeth within certain lines of influence, that the little refinements—the completion of the work, as it were, must be carried out by Nature, by the teeth settling into their permanent and normal positions under the guidance and influence of their inclined planes."

It is perfectly evident, and most reasonable, that occlusion of the teeth, to be permanent and *normal,* must conform to the several physiological and mechanical forces that influence, or control, the positions of the individual teeth. And, with the physiological forces functioning normally, just as the cusp forms and their inclined planes diverge from the geometrical, and there is lack of symmetry and harmony in the amount and form of the tooth material in the two arches, just to that degree must the normal occlusion for that individual diverge from the ideal occlusion. In my opinion it is the height of absurdity to attempt to make a geometrical proposition out of a biological problem.

Dr. Hellman, Dr. Johnson and Dr. Dewey are conferring a great benefit on orthodontia in bringing papers of this character before us in such a way that we must see these natural variations, and they teach us that we must look orthodontic facts squarely in the face for what they are and not for what we would like them to be.

I would like to ask Dr. Hellman if in his observation of skulls of the lower placental mammals he found greater variation in dental arch forms than he has found in the examination of the skulls of modern men, or if he found a greater variation in the arch form and tooth form of modern men than he found in the lower mammals?

I do not know that I can add anything further to this discussion. The paper, I believe, has been extremely valuable. The fact that some of our men would treat such a case as the first models shown on the screen indicates that many of us have much more need to study biology and anatomical variations in living subjects than we have to study ideal occlusion from plaster models.

Another of the weak points in orthodontia is the fact that we have not a large collection of records in the form of models of untreated cases. As a rule, we do not know what is going to happen to a case if it is not treated. For a patient six or eight years of age we usually predict dire results if something is not done immediately. We believe conditions will grow rapidly worse, while, on the contrary, if they have half a chance, I believe they generally improve. I was talking with Dr. Hellman a short time ago, and he made the statement that from his observation of these cases, instead of growing worse, they usually do become better.

I am glad that Dr. Hellman and these other gentlemen have searched for facts with perfectly open minds and without any preconceived theories to prove. They have submitted the facts to us and they allow us to form our own conclusions. That is what we need to do to-day in orthodontia, instead of trying to make facts fit theories.

Dr. Hellman (closing).

There is nothing I have to add to what I have already said. The question asked by Dr. Kemple, whether other animals have been investigated as to the variability in arch form, I can answer by stating that next to man the anthropoids have been most fully studied. Some phases that were not mentioned to-day, I stated in part yesterday in discussing Dr. Johnson's paper. Other investigations on the anthropoids were reported in a paper read before the New York Academy of Sciences sometime ago, and published in the *International Journal of Orthodontia* last year.* That is as far as any other mammal besides man has been investigated.

The animals that will come in next for their share of attention and investigation are the lower apes, the New and Old World monkeys.

A Research Suggested.

In conclusion, I want to bring a matter before the society which though entailing little effort for each man will be of considerable value if accomplished. One of the greatest anthropologists we have this country, Professor Boas, of the Columbia University, is interested in teeth. He has made extensive investigations and is interested in the shedding of the deciduous teeth and the eruption of permanent teeth in relation to age and body growth. I suggested that a great deal of material may be obtained if the orthodontists would furnish some records of the casts in their possession. For instance, if each man would fill in fifty charts of casts in his collection, there would be an invaluable amount of material. By anthropometric methods Pressor Boas could work out accurate scientific data pertaining to the shedding and eruption of the teeth that would be of inestimable value to us.

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*Vol. IV, No. 2, February, 1918.

A chart has been worked out which I will pass around, and if any one is interested and willing to co-operate in this movement, please communicate with me and I will send as many charts as he can fill out. The instructions on the back of the chart indicate in what manner they are to be filled in. Besides the condition of the teeth we must have name, sex, age, height, weight, occlusion, whether normal or abnormal (if abnormal, what class), and bite of the incisors, whether overbite or edge-to-edge. Anthropologists have gone into this phase of the subject rather extensively. As mentioned by Keith, in Anglo-Saxon times the English people presented an edge-to-edge bite, and a thousand years afterwards, according to this authority, it has changed to an overbite. Evolution, it seems, is working toward the overbite occlusion in the incisor teeth.

If any of you are willing to co-operate with us, we shall be very thankful, as we may thereby be enabled to return something of value at a future meeting of this society.

In the classification of malocclusion for the charts, please do not classify according to the buccal cusps, but according to the lingual cusps of the upper molar and central fossa of the lower. The model is easily looked at from the lingual aspect. The reason that I urge you not to pay any attention to the buccal cusps is to avoid confusion. In some instances the upper molar may be so rotated as to appear to be in distal occlusion, from the buccal aspect, while the mesio-lingual cusp is in normal occlusion. If we will consider this point, it will be evident that by classifying according to the manner stated, a more uniform procedure will be followed and the extent of error minimized.

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Second Annual Meeting held at Philadelphia, Pa., October 8, 9 and 10, 1902.

Third Annual Meeting held at Buffalo, N. Y., December 31, 1903; January 1 and 2, 1904.

Fourth Annual Meeting held at St. Louis, Mo., August, 29, 1904. At this meeting only routine business of the Society was transacted. There being no other program the proceedings were not published.

Fifth Annual Meeting held at Chicago, Ill., September 29, 30, and October 1, 1905.

Sixth Annual Meeting held at New York City, December 27, 28 and 29, 1906.

Seventh Annual Meeting held at Detroit, Mich., October 2, 3 and 4, 1907.

Eighth Annual Meeting held at Washington, D. C., November 5, 6 and 7, 1908.

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Fifteenth Annual Meeting held at Pittsburgh, Pa., July 20, 21 and 22, 1916.

Sixteenth Annual Meeting held at Excelsior Springs, Mo., September 5, 6, 7 and 8, 1917.

Seventeenth Annual Meeting held at Chicago, Ill., Aug. 1, 2 and 3, 1918.

Eighteenth Annual Meeting held at St. Louis, Mo., March 10, 11 and 12, 1919.

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Johnson, C. C. .... Covington, Va.
Jones, Earl E. .... 185 E. State St., Columbus, Ohio
Jones, Howard L. .... 1355 David Whitney Bldg., Detroit, Mich.
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Jones, J. M. .... Wichita, Kan.
Johnson, J. E., Jr. .... 611 Atherton Bldg., Louisville, Ky.

Kennedy, C. Angus .... 2 College St., Toronto, Ont.
Keeney, Jesse F. .... Wells Bldg., Quincy, Ill.
Kelsey, Harry E. .... 833 Park Ave., Baltimore, Md.
Kemple, F. C. .... 576 Fifth Ave., New York City
Keeler, H. D. .... 615 Hippee Bldg., Des Moines, Ia.
Ketcham, A. H. .... 725 Mack Bldg., Denver, Colo.
Kingsbury, Addison .... E. State St., Columbus, Ohio
Kohagen, J. B. .... 510 Fidelity Bldg., Nashville, Tenn.
Kregarman, S. L. .... 328 Doctors Bldg., Nashville, Tenn.

Ludt, Carl E. .... 845 David Whitney Bldg., Detroit, Mich.
Lundstrom, Alex .... Riddaregatan 7, Stockholm, Sweden.
Lourie, L. S. .... 25 E. Washington St., Chicago, Ill.
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Locke, J. D. .... Ashton Bldg., Grand Rapids, Mich.
Lischer, B. E. .... Wall Bldg., St. Louis, Mo.
Lea, W. J. .... 501 Birks Bldg., Vancouver, B. C.

Martin, Wm. W. .... 724 Metropolitan Bldg., Kansas City, Mo.
McCarter, W. A. .... Topeka, Kan.
Mershon, John V. .... 1520 Spruce St., Philadelphia, Pa.
McCarty, O. H. .... Tulsa, Okla.
Mann, Chas. C. .... 1004 Cobb Bldg., Seattle, Wash.
McDonald, R. T. .... 11 Federal Life Bldg., Hamilton, Ont.

McClain, Harris W. ....25 E. Washington St., Chicago, Ill.
McClelland, Alonzo Wright. .Birks Bldg., Montreal, Quebec, Can.
McCreary, W. H. ....807 Week Bldg., Youngstown, Ohio
Morrison, James B. ....Birks Bldg., Montreal, Que.
McCoy, J. D. ....908 Brockman Bldg., Los Angeles, Cal.
Morehouse, H. L. ....1002 Paulsen Bldg., Spokane, Wash.
Munroe, Grafton ....Springfield, Ill.
McCarty, Ira E. ....611 Daniels Bldg., Tulsa, Okla.
McCaule, C. M. ....Dallas, Texas
MacDonald, F. W. ....825 David Whitney Bldg., Detroit Mich

Nelson, J. Frank ....25 E. Washington St., Chicago, Ill.

Oliver, O. A. ....349 Doctors Bldg., Nashville, Tenn.
Ottolengui, R. ....80 W. 40th St., New York City

Peete, J. W. ....508 Exchange Bldg., Memphis, Tenn.
Pullen, H. A. ....Allen St., Buffalo, N. Y.
Parsons, J. W. ....First Nat'l Bank Bldg., Huntington, W. Va.
Pollock, H. C. ....809 Metropolitan Bldg., St. Louis, Mo.
Potter, Homer A. ....508 Commerce Bldg., Kansas City, Mo.

Reed, Chester B. ....400 Mills Bldg., Topeka, Kan.
Robinson, R. D. ....307 W. 8th St., Los Angeles, Cal.
Rodgers, F. C. ....Wall Bldg., St. Louis, Mo.
Ruchstuhl, Urling ....813 Metropolitan Bldg., St. Louis, Mo.
Richardson, Eliz. E. ....2428 Bancroft Way, Berkeley, Cal.
Rogers, A. P. ....520 Beacon St., Boston, Mass.

Scott, Allen Everett ....
......914 Butler Bldg., 135 Stockton St., San Francisco, Cal.
Schlencker, Eda B. ....342 Cutler Bldg., Rochester, N. Y.
Schroeder, E. R. ....2328 Santa Clara Ave., Alameda, Cal.
Stoft, W. E. ....210 McCague Bldg., Omaha, Neb.
Suggett, A. H. ....Butler Bldg., San Francisco, Cal.
Sobey, Arthur W. ....323 Geary St., San Francisco, Cal.
Sorrels, F. W. ....516 Colcord Bldg., Oklahoma City, Okla.
Summa, Richard ....3834 Botanical Ave., St. Louis, Mo.

Sterret, D. S. .... Erie, Pa.
Shaddock, F. J. . . 819 Chamber of Commerce, Bldg., Rochester, N. Y.
Sargeant, Walter S. .... 1508 Nicholas Bldg., Toledo, Ohio

Tanzey, Hugh G. .... 508 Commerce Bldg., Kansas City, Mo.
Taylor, H. W. .... W. 50th St., New York City
Turney, C. A. .... Locust St., Philadelphia, Pa.
Tileston, H. B. Jr. .... 916 Starks Bldg., Louisville, Ky.
Taylor, M. T. .... Fon-du-lac, Wis.

Vance, A. D. .... 25 E. Washington St., Chicago, Ill.

Wenker, R. J. .... 407 1st Nat'l Bank Bldg., Milwaukee, Wis.
Woods, Carleton W. .... 576 Fifth Ave., New York City
Waugh, L. M. .... 576 Fifth Ave., New York City
Wulfman, Armine E., 202 1st Nat'l Bank Bldg., Huntington, W. Va.
Woods, F. R. .... 1123 David Whitney Bldg., Detroit, Mich.
Woodbury, W. W. .... Halifax, N. S.
Wheat, S. C. .... 1207 Rialto Bldg., Kansas City, Mo.
Willett, R. C. .... 528 Jefferson Bldg., Peoria, Ill.
Waldron, Ralph .... 549 High St., Newark, N. J.
Woods, C. W. .... 576 Fifth Ave., New York City
White, O. W. .... Fine Arts Bldg., Detroit, Mich.
Watson, M. T. .... 1123 David Whitney Bldg., Detroit, Mich.
Weeks, S. M. .... Spruce St., Philadelphia, Pa.
Wheeler, C. W. B. .... E. 38th St., New York City
Webster, R. L. .... 48 Whitmarsh St., Providence, R. I.
Walker, J. L. .... 505 Taylor Bldg., Norfolk, Va.
Weeks, E. G. .... Saginaw, Mich.
Weston, R. B. .... 255 State St., Albany, N. Y.
Weinberger, B. W. .... 40 E. 41st St., New York City

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If there are any errors in names or addresses please notify the Secretary.

President's Address

By John V. Mershon, D. D. S., Philadelphia, Pa.

Read before the American Society of Orthodontists at Chicago, April 5th, 1920.

It is with a feeling of deep appreciation that I accept the honor you have conferred upon me by selecting me as President of the American Society of Orthodontists, and I extend to the members and our guests a most cordial welcome.

Our objects in attending these meetings are many: First, and by no means the least important, that we may meet old friends and renew our friendship with those we have learned to love, and receive that inspiration which comes to men's souls from contact with the high type of manhood with which this society is so richly blessed.

Problems in Orthodontia.

We come here that others may help to solve our problems for us, and that, perchance, we may help to solve the problems of some of our fellow members. Our problems are many. We are here, not only to solve our own problems, but the entire dental world is looking to this organization to solve the orthodontic problems and to direct and teach them, and this is a responsibility that we must assume. We must remember that we as specialists are only practitioners in a special department, and that our patients are in the hands of the general dentist before they come to us.

Focal Infections.

This organization must direct the general practitioner, as well as the undergraduate student, in the problems of pre-orthodontic treatment. In the past, the orthodontists have impressed upon the dental profession the necessity of saving and restoring all teeth to their original size and contour, especially the first molars and all deciduous teeth. The development of the last few years has impressed upon the profession as well as the laity the fact that certain diseases and organic lesions have their origin at the apices of infected teeth, and these conditions have presented several new problems to the orthodontist.

In the case of first permanent molar teeth in which the pulps are dead and infected prior to the eruption of the second molars, the orthodontist from the standpoint of occlusion and development would recommend them to be filled, but with the possibility of infection from these teeth, another problem is presented, and from the standpoint of the pathologist these teeth should be extracted. If extraction is the final decision, at what period in relation to the eruption of the second molar should the extraction be done? And what is the correct procedure to adopt in the orthodontic treatment of these cases?

Diseased Deciduous Teeth.

The attitude of the orthodontist in the past regarding the deciduous teeth has been very much the same as with the permanent molars, namely, that we must fill all pulpless deciduous teeth; that no matter how badly broken down these teeth may be they should be restored to their original size, shape and contour. This would be permissible if we were studying the operation purely from the standpoint of occlusion, but our problem is one of functional development, and anything that interferes with the development of the child is a causative factor in malocclusion.

Infection of teeth is one of the most common causes of organic disturbance which have a retarding influence upon the growth and development of children. A deciduous tooth with infected roots is most difficult to treat and fill, so that we can be assured that the possibility of infection and the constitutional disturbances resulting therefrom have been eliminated, and from this standpoint it has been my practice and advice to have all deciduous teeth with nonvital pulps removed. I should like to have this subject discussed at this meeting, as this organization is very largely responsible for the efforts of the general practitioner, and sometimes against his better judgment, to save all first molars indefinitely, and to retain all deciduous teeth until time for the eruption of the teeth of the permanent series, irrespective of apical conditions.

Preparation for the Practice of Orthodontia.

Years of experience in general practice and in the specialty of orthodontia have impressed me with the necessity for the undergraduate student to receive a thorough comprehension of the orthodontic problem so that when he continues his work in special schools these institutions can devote their attention to teaching real post-graduate subjects, clinical work, rather than having to teach subjects which should have been taught in the undergraduate institution. I disapprove of dentists specializing in orthodontia as soon as they graduate from the dental college and before they have had any experience in dealing with the large variety of conditions which may exist in the oral cavity, and which one never has the opportunity of observing and studying in the practice of orthodontia, unless the post-graduate school includes in its work one or two years of practical work in a dental infirmary. In orthodontia we see only children and those children that are defective in their development; we have no opportunity of knowing what possible conditions may arise in the mouth through the rest of the life history of the individual, and that is most essential. If a man has had a number of years experience in the general practice of dentistry, he has seen the masticatory organ in all of its different phases of development, under all conditions and circumstances. He has seen what a child of six will be at ten, what a child of ten will be at fourteen, and what one of fourteen will be at twenty-five; and he has had a better opportunity to study the function of the masticatory apparatus. The orthodontist sees the dentures when they are at their best, and when we dismiss them they are only just started upon their life's journey.

Orthodontia Inseparably Related to Dentistry.

The opinion seems to prevail that orthodontia is something different, apart, separate and distinct from dentistry. Orthodontia is just as much a part of dentistry as dentistry is a part of medicine, or as surgery is a part of medicine; they are all a part of the healing art and cannot be dealt with separately any more than we can separate the various organs of man and have him survive. The orthodontist should keep in touch with the progress and changes in general dentistry, and to that end he should be just as constant in his attendance at dental society meetings as the men in general practice.

I have so frequently heard it said, and it seems to be a prevalent opinion, that one can attend a post-graduate school of orthodontia and in a comparatively short time become a proficient orthodontist. I want to disabuse the minds of the men who are anticipating going into orthodontia, of this impression; it cannot be done. If there is so little in the orthodontic problem that a student who has just graduated from a dental college without any experience can in a few weeks become qualified to do the work satisfactorily, then orthodontia should not be considered a specialty. If this were true, the undergraduate schools could, by giving a selected course, qualify men for the practice of orthodontia as well as the post-graduate schools. While I am quite willing to admit that the majority of the men who belong to this organization did not have a very long course of instruction, I think the majority of those who have had a long experience will admit that their instruction was very inadequate. I do not wish to minimize the work done by some of the post-graduate schools, but the study of orthodontia involves all the problems of life, growth and development, as it is modified by heredity and environment and requires an enormous amount of study and an extensive actual experience to practice it successfully, and this cannot be acquired in a few weeks.

I want to express my appreciation of the splendid work done by the Board of Censors. They have prepared for this meeting a most excellent program of papers, reports of cases and clinics. The amount of labor entailed in preparation for a meeting of this kind, making all arrangements for the program and for all other details of the meeting, can only be appreciated by those who have had similar experience. I sometimes feel that those who have nothing to do but to sit and enjoy the benefits to be derived from such a splendid program seldom realize how much they owe to the Board of Censors. Every member of this organization should feel that it is his duty to co-operate for the betterment and the upbuilding of the society. We sometimes thoughtlessly criticize when certain features of a meeting do not come up to our expectations, forgetting that when we offer a criticism we should suggest the remedy.

Death of Dr. Law.

The members of the American Society of Orthodontists mourn the loss of our fellow member, Dr. William G. Law, who by his sterling character had endeared himself to all of us.

I extend to the officers and the Board of Censors for the coming year my best wishes and assurances of my loyal support.

Discussion of President's Address.

Dr. J. Lowe Young.

Unfortunately neither of the gentlemen who were selected to formally open the discussion on Dr. Mershon's address are present. Therefore, I will ask Dr. Pullen if he will be good enough to open the discussion for us.

Dr. H. A. Pullen, Buffalo, N. Y.

Mr. Chairman, Members of the Society: I am afraid I am not well qualified on such short notice to discuss so many important subjects as were brought up by our President. While he was reading I was thinking of a paper by Dr. Young, read not long ago, and which was called "The Permanent Filling of the Temporary Teeth." I did not hear the paper, but am sure it must have been a splendid one, and along the line in which we are all interested. I have no doubt it dealt with the very conditions we have to deal with every day where we find the deciduous teeth going all to pieces because the dentist lets them go to pieces. By the permanent filling of these temporary teeth, they are prepared for the dental arches that are to follow. I hope Dr. Young will tell us something about what he had to say in that paper.

After teaching in a post-graduate school I am fully convinced that a short-term school does not give enough practical or enough theoretical work to enable anyone to start out competent. I think a year's course, at least, should be given to a man who is looking for post-graduate instruction in orthodontia. The President said that many of our members had received only a short-term course in orthodontia. It is true that was all we had to begin with, but many of us have been working in a post-graduate course for twenty or twenty-five years, or more, and do not feel that we have graduated yet. If it takes that long to feel that we are really getting started, surely the new comers should have at least a year to give them a proper start.

I feel, as I am sure we all do, the loss of Dr. Law and the other members who have died during the past year, and I count it as a very great loss to the American Society of Orthodontists. Dr. Law had planned to have an academy of orthodontia in New York City, and with him at the head of it I am sure it would have been a very good school. We have sustained a very great loss in the death of Dr. Law, for that reason if for no other, and we all know that he was a very lovable man in every respect.

I am sorry that on such short notice I cannot offer you any better discussion. Thank you.

Dr. B. E. Lischer,
St. Louis, Mo.

Mr. Chairman and Members of the Society: I do not feel qualified to discuss this very excellent address on a moment's notice, but the President has brought up the subject of dental education, and hence I consent to make a few remarks.

At the annual meeting of the Association of Dental Faculties of American Universities, held in Detroit, in January, I had the honor of presenting a *Syllabus of a Course in Orthodontics for Undergraduates.* I found this Association is preparing a syllabus for every subject in the dental curriculum, and that the entire work is to be published. Since then, Drs. Mershon and Johnson have been asked to serve with me in the final preparation of the course in orthodontics. I believe that the publication of such a syllabus is a step in the right direction, and I sincerely hope that this society will lend its assistance in a matter so important. I believe that we should continue our committee on education, and I would suggest that it co-operate with the Association to which I referred. The dental faculties of our universities are wide awake to the fact that they must not only provide undergraduate instruction in orthodontics, but advanced training for those who would specialize. They realize that the training of the orthodontist is a question which cannot be evaded much longer, and that the specialist, as well as the public, suffer immeasurably by the continuance of his training in private schools, where 's'hort cut" courses, based on the ideal of the mechanician, often predominate.

I recall now that in my presidential address before this society at our meeting in Chicago, June, 1913, I made similar reference to the subject of orthodontic education, and I am happy to note that events are shaping themselves in complete conformity with the ideals to which I then gave utterance.

Dr. V. E. Barnes, Cleveland, Ohio. Mr. Chairman and Fellow Members of the Society: We have listened to the brief and beautiful address of our President, which was so much to the point and to me it was all commendable. I want to add just two things that I have jotted down in commendation.

Our orthodontic treatment should begin only after we are reasonably certain that all the teeth are free from infection. Believing this for more than ten years, I have insisted that all teeth that could not be treated and made free from infection should be extracted. I have especially insisted upon this action in regard to the temporary teeth. The premature loss of temporary teeth does not cause anywhere near the amount of malocclusion credited to it. The real cause is underlying, and the loss of the temporary teeth only aggravates or changes the form of malocclusion. The real loss following premature extraction of temporary teeth is loss of masticatory surface, and the loss of some of our anchorage which we should like to use to mould bone so that permanent teeth may erupt to better positions.

I wish to commend the stand against dentists just out of college specializing immediately as orthodontists.

Dr. John V. Marshon (closing). Mr. Chairman, Members: I can only add, in closing, that I appreciate the very kind and complimentary way in which my very brief address has been received. I have said in the address all that I had to say, and I thank you very much.

Recent Advances in Oral Pathology.

By Arthur Hopewell-Smith, Sc.D., L.R.C.P., M.R.C.S., L.D.S., Professor of Dental Histology, Pathology and Comparative Odontology, University of Pennsylvania, Philadelphia, Pa.

Read before the American Society of Orthodontists, Chicago, Ill., April, 1920.

Introductory. The subject announced as the title of this paper is of such great importance, and covers so wide an area, that it is impossible to do anything like adequate justice to it in the time at the disposal of the writer. It will be well, therefore, to consider it from the dental viewpoint only and to restrict even that to some matters which, having come immediately under the notice and investigation of the speaker, should be of interest to his present audience, who deal so largely with the dental requirements of children, the main idea being the stimulation of thought and the encouragement of further and more serious work in the investigation of dental and oral pathology. For it is a lamentable fact that toilers in this field are few and far between, and the surface of the ground is only beginning to be scratched and dug into. Attention may be directed, therefore, to a few remarks on "Dental Caries," "Pyorrhea Alveolaris," and "Diseases of the Dental Pulp."

Dental Caries. Of all branches of dental pathology the study of dental caries is supreme in everyday work. So universal are its manifestations, so widespread and devastating its effects, that it is a question of curious interest that investigations as to its origin and nature have but seldom during the last few years been undertaken. It is assumed that the doctrines of Miller (1), Leon Williams (2), Goadby (3), Black (4), Walkhoff (5), Pickerill (6), and other authorities hold good, and, in some quarters, the opinion is expressed that there is no necessity for further prosecution of its etiology. This is a non-progressive and unscientific attitude of mind, for bacteriology

—a comparatively new science and of high importance in this connection— has done, and is doing, much in the way of advancement.

Most Recent Theory Regarding Cause of Caries.

Amongst the latest writers on the causation of dental caries is Eckermann (7), who, from the viewpoint of the physicist and chemist, rather than that of the clinician, now attempts to shatter the lactic acid theory of Miller. He contends, briefly, that this condition is not caused by lactic acid but by osmosis. Regarding the dentin as a semipermeable membrane, he maintains that it acts chiefly at the gingival margins of the teeth—where bone atrophy has occurred—as an osmotic membrane; regarding also human enamel as defective in structure, he declares that osmosis takes place even in this tissue.

The process, as he conceives it, would appear to be as follows: In consequence of the large amount of salt and sugar consumed by civilized peoples, the saliva becomes loaded with dissolved material of a greater specific gravity than the lymph in the dental pulp. Osmosis occurring at the weak spots in dentin and enamel already mentioned, it follows that the lymph is forced into the dentin and ultimately into the enamel, forming colored tracts which, on becoming infected by micro-organisms, he calls "caries canals."

This astonishing, wholly irrational, fantastic and incorrect theory is the latest. Reference to it is only here made to demonstrate that a question like the causation of dental caries can be used at times as an opportunity for the display of colossal ignorance on the part of incompetent observers for the exploitation of certain ends. It can really only be settled satisfactorily by the concerted action of dental surgeon, histologist, biologist, chemist, physiologist and pathologist—and common sense. The concept has probably arisen from the erroneous interpretation placed upon the histological appearances of dentin and enamel following the injection at high pressure of stains and dyes by means of a hyperdermic syringe in the pulp canal, as advocated and practiced by von Beust. Thus recent advances become retrogressive and therefore harmful.

The results of the above are highly unsatisfactory and entirely misleading. The etiology of dental caries is not yet thoroughly known; its problems by no means solved. In this connection a resolution passed by the Third International Dental Congress in Paris may be recalled: "Our present knowledge of dental caries cannot explain the different forms of this malady." After study of the question, extending over many years, the speaker has come to the following conclusions:

The only certain things known about it are its signs, its complications, its external origin, its contemporaneousness with early life. That

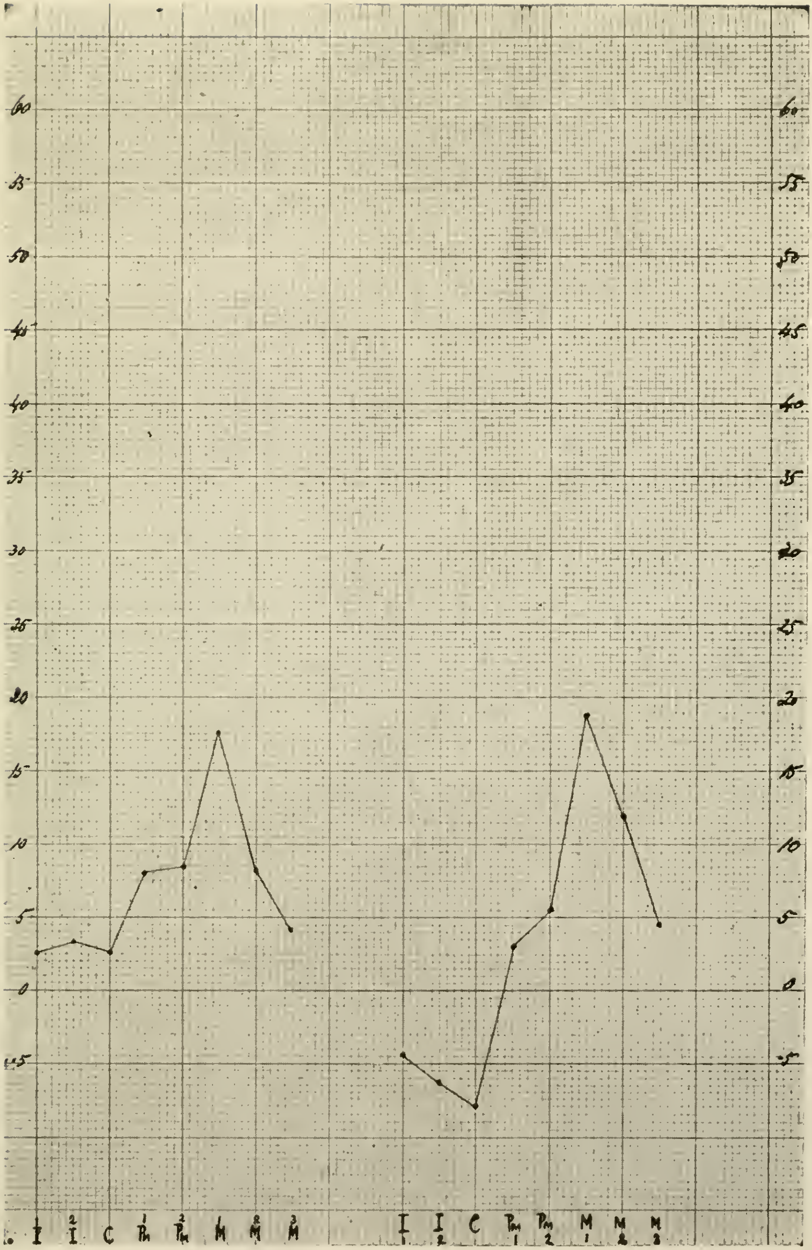
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Chart I.

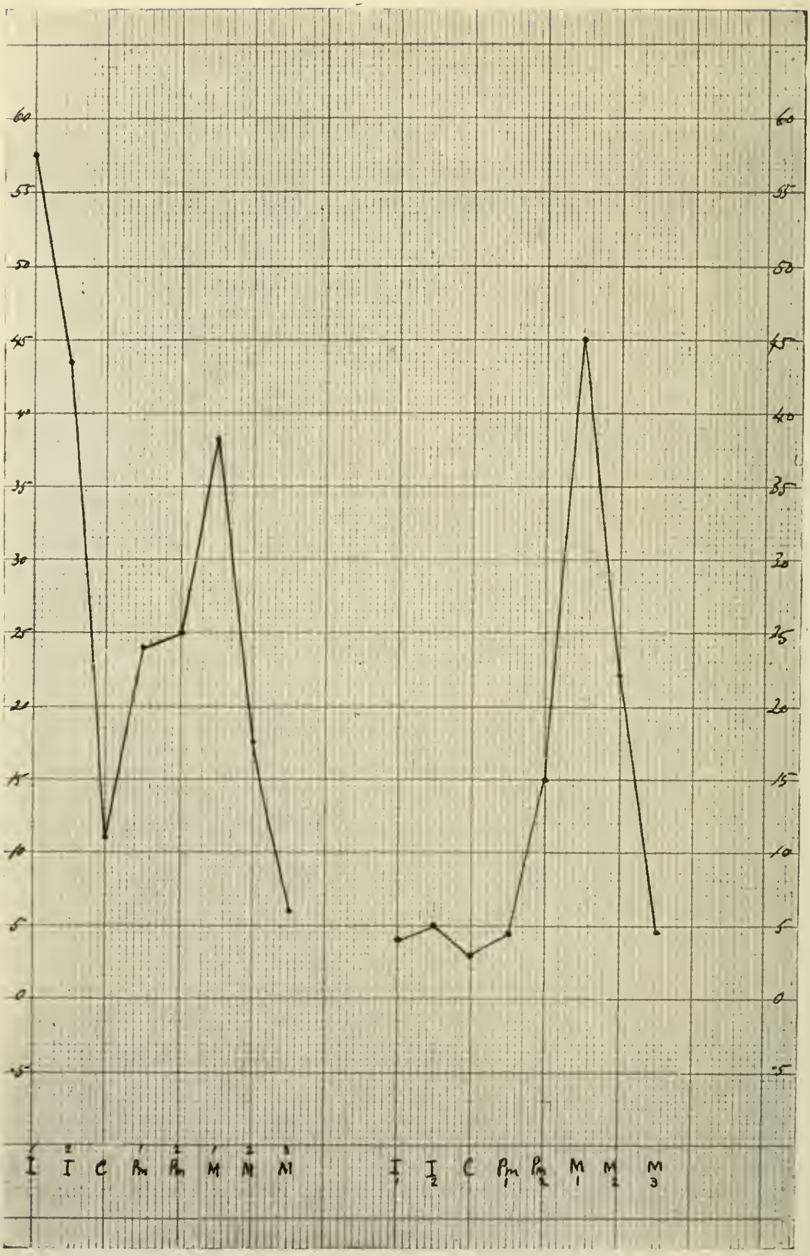
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CHART II.

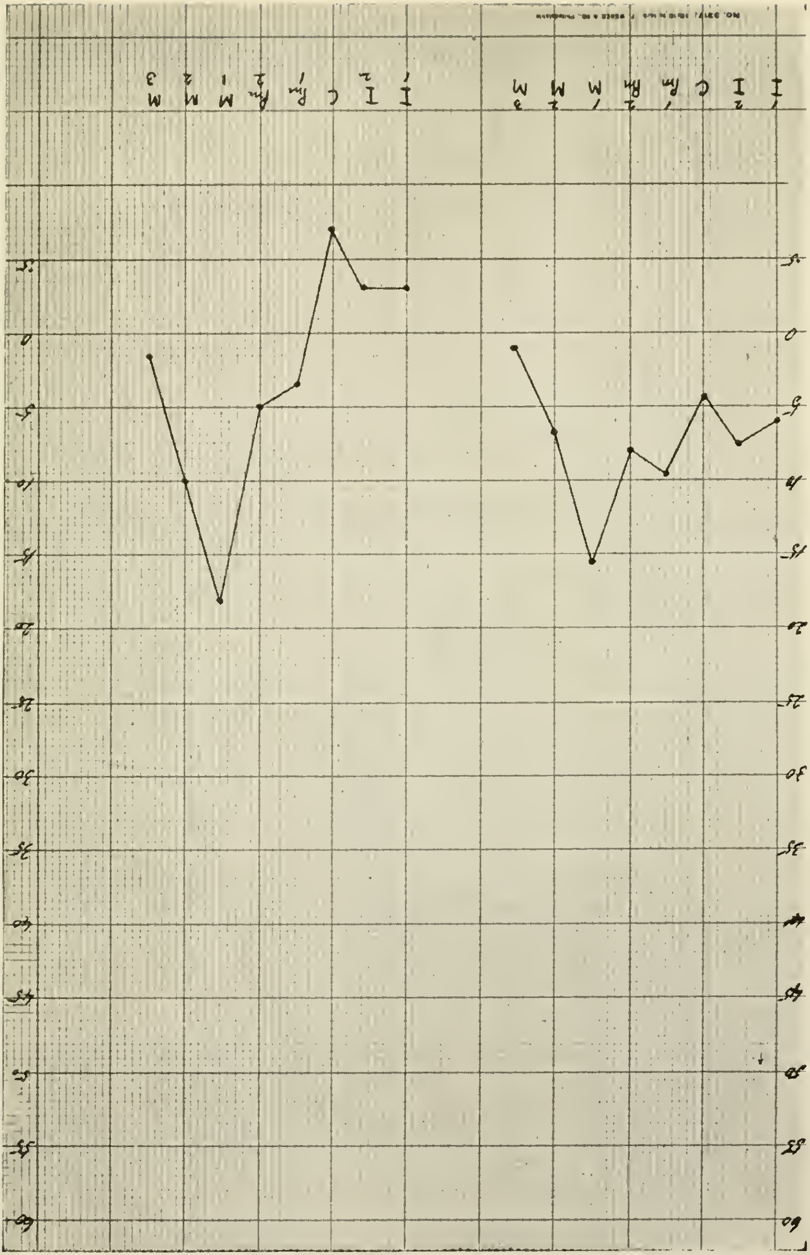

Chart III.

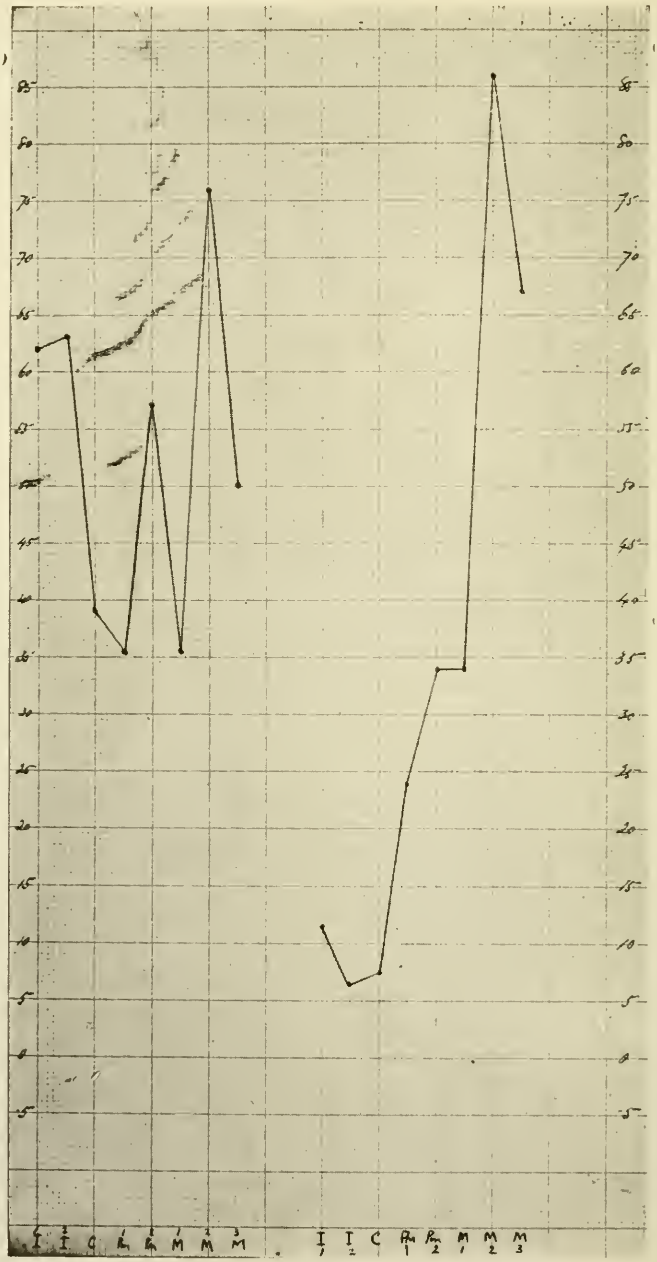
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CHART IV.

it is a molecular disintegration of the hard tissues, beginning in decalcification of inorganic constituents and ending in the dissolution of their organic parts, is generally believed, but its causes, and even which teeth are most seldom or most frequently the object of its attack, are unknown.

With regard to the relative dental susceptibility G. V. Black probably got nearer the truth than any other authority.

The accompanying charts show the percentages of dental caries occurring: (Chart I) in twelve thousand extractions (Magitot); (Chart II), in thirty thousand extractions (Pare and Wallis); (Chart III), in private practice, records of occurrence during adolescence (G. V. Black); and (Chart IV), in dental hospital practice, all ages (Lewis and Hopewell-Smith). The side numerals indicate the percentages. The letters with their numerals indicate maxillary teeth when the numeral is above the letter, mandibular teeth when below the letter. The new terminology is here adopted.

It is thus seen that Charts I and II give the maxillary first molar and mandibular first molar as the most frequently affected; Chart III the first maxillary incisor, and Chart IV the second mandibular molar and second maxillary molar. But the truth cannot be thoroughly determined except by the combined action of a committee of dental men carefully noting the onset of the condition, unanimous in their conception of the phenomena that constitute the initial stages, and willing to devote some time to charting mouths, and generally adopting the principles as set forth on the covers of every copy of the *Dental Cosmos*—of "Observing, comparing, reflecting and recording."

Dental Caries Not a Disease.

Dental caries is strictly not a disease; it is not caries. It does not resemble, in the very slightest, caries of bone, which is a form of ulceration, following an osteitis due to subacute inflammation, or tuberculosis, or syphilis. A cavity in the hard palate, which is often produced during the course of tertiary syphilis is a manifestation of the disease, is a necrosis of the bone—not a disease itself. Caries of enamel and dentin is not a disease, but a sign or manifestation of an external pathological condition affecting the environment of these tissues. It cannot be communicated from person to person. It is neither strictly infectious nor contagious.

Further, dental caries can be so closely imitated in almost every particular *in vitro,* that the same condition, developed *in vivo,* cannot, under the microscope, be distinguished from it. Moreover, it cannot be induced by inoculation in the tissues of the teeth *in situ;* neither can carious dentin, when placed in an artificially prepared cavity in a sound tooth.

infect the healthy dentin, nor extend from a carious deciduous tooth to its unerupted successor beneath.

What is its origin? Something occurring in the mouth must be the cause. The fermentation of carbohydrates in the food, followed by the production of lactic acid, and possibly other acids, is today generally accepted as the exciting factor. Yet it should be well known that the growth and action of the oral flora are inhibited by the presence of an acid medium. Mouth bacteria develop on alkaline or neutral media. Paradoxical though it may appear, it follows, therefore, that it is almost certain that acid solutions of vegetable or chemical character will prevent its onset.

New Definition of Causation.

Dental caries may be considered to be a sign (or symptom) and a consequence, or result, of certain disturbances in the symbiosis, antibiosis and commensalism of the flora of the mouth, occurring chiefly in early life, of which the precise nature is at present unknown. In other words, dental caries is a complication of the pathological condition produced by disharmonious relations existing at times between the various kinds of oral bacteria. Fuller investigations in this direction are greatly needed. The writer, however, believes the above to be the truth.

Age Incidence.

It is a well recognized fact that the closer he attains to adult life the less and less liable ("susceptible?") to dental caries does an individual become, and therefore, that dental caries is a condition of the teeth peculiarly associated with infancy and adolescence.

In response to inquiry submitted some time ago by the writer to a number of dental surgeons particularly interested in the matter as to why this should be, the following suggestions were offered: Children eat great quantities of sugar in the form of candy; infectivity; differences in constitution and character of the saliva or oral secretions predisposing to and facilitating lactic acid fermentation of carbohydrates; some teeth being physically and structurally more susceptible than others; congenital dental defects; the "brittleness" of newly erupted teeth; incomplete calcification of the dental tissues; children's illnesses; sugar diet; non-use of substances such as "coffee, tobacco, wine, spirits, etc.," supposed by some people "to neutralize the saliva," etc.

Why is Caries Most Frequent During Youth?

The following may be given today as the probable and common sense reasons:

1. The adult has a freer flow of saliva than the child, which, acting mechanically, washes away from Nasmyth's membrane and the surface of the enamel many bacteria in available positions. This copious flow of saliva is dependent on the excitation of the secretory

nerves of the salivary glands, viz., the cervical sympathetic, glossopharyngeal, and *chorda tympani*—brought about largely by stimulation of food, muscular movements, presence of acids in the mouth, and the frequently occurring reflexes of the optic, olfactory and gustatory nerves. These are yet being developed in the child, whose glandular apparatus and activities of the organs of sense are as yet inexperienced.

2. The process of phagocytosis is more effective at this period through the complete development and growth and proper functioning of the tonsils. It is extremely probable that the leucocytes in the mouth, which are phagocytic in function, are derived from the tonsils. Weak children, predisposed to tuberculosis, often suffer from chronic hypertrophic tonsilitis. Here the process of phagocytosis is presumably impaired, and fewer opportunities for combating and destroying harmful bacteria are presented.

3. The physiological resistance and defensive mechanisms of the mouth, as of the body, generally of the adult, are greater than those of the child.

4. The food of the adult is more complex and perhaps often somewhat more acid in character than that of the child. Generally speaking it is more solid in substance. The caries-producing organisms become, therefore, incorporated into the bolus of food and carried into the stomach, where they are immediately destroyed by the gastric juice.

5. The adult obeys the rules of oral hygiene more frequently and more effectively than the infant, using mechanical means for getting rid of caries-producing organisms by washing his mouth, drinking water or other fluids, cleansing with tongue and lips, as well as actually brushing the teeth.

The numbers of bacteria found in the secretions of the healthy oral cavity have been computed by F. W. Andrewes (8), as from ten to a hundred million per cubic centimeter. As the stomach and duodenum empty themselves properly after each meal, the former is well scoured and a large proportion of the oral bacteria swallowed perish during digestion, these two portions of the alimentary tract containing extremely few in a healthy state. But in the caecum and colon, in consequence of highly favorable conditions, the bacteria are enormously multiplied and their number as estimated per gramme of normal excreta, range from a hundred to a thousand millions.

Prevention of Caries.

It is obvious that to diminish the occurrence of dental caries in childhood and adolescence, and prevent it at later periods of life, all effort should be taken to reduce the number and to inhibit the growth and action of bacteria. This can be done equally well, if not better, by the free use of water and mechanical and muscular aids—brush, lips, tongue—than by the exhibition of antiseptic mouth washes, powders and soaps. An acid mouth wash is extremely desirable, at times.

"Pyorrhea Alveolaris."

Probably the next most discussed subject in dental pathology is that of "pyorrhea alveolaris." Much confusion as to the nature of this condition exists. Contrary to dental caries, it is generally understood to be found exclusively in adult life. The writer has repeatedly seen it in children, as early as ten years, sometimes predisposed to it by acute attacks of scarlet fever, followed by severe and persistent anaemia. Contrary to the ccepted opinion, "pyorrhea alveolaris" is not a disease; it is, as the name implies, an exudation of pus from the gingival troughs. It is a symptom of oral sepsis, as it is also a symptom of dento-alveolar abscess and of catarrhal and mercurial stomatitis.

Pyorrhea a Symptom of Oral Sepsis.

With regard to the first-named oral condition, it may be the only sign. One of the reasons why there is so much mental confusion over this subject is because of the failure on the part of the dentist or physician to recognize always the nature of the exudate material at the gingival-dental margins. If the microscope were more frequently brought into use in this connection alone, fewer mistaken diagnoses would be made. The observer jumps to conclusions too readily. The writer recalls the case of a man in mid-life who apparently presented most of the signs of secondary (pernicious?) anaemia, attributed by his medical man to "pyorrhaea alveolaris." The face, gums, lips, cheeks, tongue were practically colorless. The diagnosis was septic intoxication from "pyorrhaea alveolaris." The patient had no appreciable degrees of oral sepsis; the pale appearance of the mucous membrane and skin being really due, it ultimately transpired, to cancerous cachexia, for he died of a gastric carcinoma.

It is necessary to examine the exudate under the microscope before one can actually state that pus is present in such and such a case. It is equally necessary to make a blood count, preferably by means of an accurate and rapid method in which the Thoma-Zeiss pipette and microscopical slide are employed. In less than ten minutes the number of red and colorless blood corpuscles per cubic millimeter can be estimated.*

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* The enumeration of blood corpuscles can be obtained by the following method:

A certain amount of blood is drawn from the supposedly affected individual and diluted a known number of times with sodium sulphate solution of S. G. 1025.

The diluted blood is evenly spread on a special glass slide, hollowed

If examination of the gingival exudate and the making of a blood count were more frequently practiced, much more satisfactory knowledge of the true nature and character of "pyorrhea alveolaris" would be obtained.

"Pyorrhea alveolaris" may be regarded as a very simple symptom of a somewhat obscure disease of the oral cavity, viz., oral sepsis. If an infection of the mouth occurs and pathogenic organisms abound and perhaps predominate, "pyorrhea alveolaris" may become manifest, provided that local conditions are suitable.

Local Conditions Predisposing to "Pyorrhea Alveolaris."

1. Atrophy of the margins of the alveolar process, the result of anaemia, and the unusual, and in fact unique, anatomical characteristics of the parts and deepening of the gingival trough, is of great importance. The latter is associated with mal-occlusion, traumatism, infection from decomposing food, etc.

2. A suitable nidus for the development of pyogenic organism, the normal contents of the gingival trough, which generally extends from two to three or three and one-half millimeters, are desquamated epithelial cells, saliva, débris of food, polymorpho-nuclear leucocytes and bacteria of the *micrococcus catarrhalis* and *streptococcus* type.

In the early stage of this infection of a "pocket" the gums are normal or anaemic, and appear to be shrunken with the physiologically absorbed or atrophied bone beneath; pus exudes on pressure only; the teeth are not loose; the breath is foul, but there is *no pain.*

Later on, a gingivitis is present, with or without periodontitis. The pockets are deep, pus is copious, the roots of the teeth are exposed and

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out on its upper surface and ruled in the center in a square measuring one square millimeter. This is subdivided into sixteen smaller squares, each of which is again subdivided into twenty-five very small squares. When a cover glass is placed over the cell 0.1 mm. deep, each smallest square contains 1/4000th of a cubic millimeter of diluted blood.

Under the microscope the number of squares covered by the blood, is ascertained, and the number of erythrocytes (red cells) and leucocytes which are easily recognized, noted. By means of the following formula an estimation of the number of corpuscles per cubic millimeter is accurately made; if A = the number of corpuscles counted, B = the number of squares counted, and C = the number of times the blood has been diluted:

$$\frac{A \times C \times 4{,}000}{B} = \text{number of corpuscles.}$$

A normal blood count contains, per cubic millimeter, 5,120,000 erythrocytes and 7,000 leucocytes. If secondary anaemia is suspected and exists, an examination will probably show erythrocytes 3,000,000 and leucocytes 23,000 per cubic millimeter.

are themselves loose, but not painful unless the periodontal membrane is inflamed; the breath is foul.

Diseases of the Dental Pulp.

Disturbances of the circulatory and nervous systems are the chief exciting causes of inflammation and degeneration, which sums up in two words the chief pathological conditions of this all-important and vital organ.

The general predisposing causes may be grouped as due to (1) heredity, (2) sex, (3) age (the pulps of deciduous teeth, in addition to becoming inflamed, frequently undergo degeneration of a fibroid or calcareous type), (4) marasmus, (5) long-continued fevers.

Local Predisposing Causes.

The local predisposing causes, based on the unique anatomical and physiological characteristics of the pulp, are as follows:

1. Absence of collateral circulation, which nullifies any attempts at reparative action or healing of parts of individual regions of the tissues;
2. The valveless construction of the veins, thus inducing and favoring the production of venous hyperaemia;
3. Lack of an organized lymphatic system, carrying away waste products and inflammatory exudates;
4. Its enclosure in unyielding walls of dentin, which thus injures it through accumulation of exudates;
5. Absence of *direct* nervous control over its environment;
6. Its constant subjection to rapid and extreme changes of temperature;
7. The frequent presence of fillings, which are thermal conductors and alter the physical qualities of dentin;
8. The frequent presence of adventitious dentin, which diminishes the cubic capacity of the pulp cavity;
9. The early normal closure or complete formation of the apical foramina of the teeth themselves.*

All of the above, severally or collectively, have a marked effect in the production of hyperaemia and inflammation, with their varieties and terminations.

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* The dates of "closure," or complete formation of the apical foramina of the individual teeth is approximately: Maxillary first incisor, eleventh year; maxillary second incisor, eleventh year; maxillary canine, thirteenth year; maxillary first premolar, twelfth year; maxillary second premolar, twelfth year; maxillary first molar, twelfth year. maxillary second molar, fifteenth year; maxillary third molar, nineteenth year; mandibular first incisor, tenth year; mandibular second incisor, 11th year; mandibular canine, thirteenth year; mandibular first premolar, twelfth year; mandibular second premolar, twelfth year; mandibular first molar, eleventh year; mandibular second molar, sixteenth year, and mandibular third molar, twenty-first year.

Recent observations completely confirm the existence, on clinical and physiological grounds, of the segmental areas of the skin of the face, originally described by Professor Henry Head (9) as valuable aids to diagnosis. One is beginning to know something of the phenomena of odontalgia or neuralgia set up at times in teeth which have no recognizable lesion.

Causes of Obscure Odontalgia.

It can therefore be related that obscure causes of odontalgia may be ascribed to the following (10):

1. Increased or diminished blood pressure in the pulp;
2. The presence of pulp nodules;
3. Altered chemical constituents of the blood;
4. Intra-oral electrical impulses;
5. Reflex conditions associated with the gustatory and *chorda-tympani* nerves;
6. Pathological diseases of the fifth nerve; and
7. General neurasthenia and debility.

Finally in an important society such as this, whose members are chiefly concerned in the treatment of children, who can be watched more easily than their parents, many opportunities must arise for the prosecution of an investigation on some of the argumentative subjects briefly referred to above—researches of high value and of lasting benefit to dental science and the community at large.

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Discussion of Dr. Hopewell-Smith's Paper

Dr. M. N. Federspiel, Milwaukee. It seems to me orthodontists who appreciate the prognosis of malocclusion, who can appreciate the difficulties they have to encounter, will sooner or later, if they do not at the present time, realize that in our science, or I might better say, in our branch of medicine we must have a better understanding of the fundamental principles of histo-pathology.

I cannot go into the question of decay of the teeth, much as I would like to, because I am not prepared. I enjoyed Dr. Smith's remarks about the so-called pyorrhea alveolaris, and the importance of discriminating between the pathological phases that take place.

I believe we have not been devoting enough time to the study of focal infection, and we must give more consideration to the pathological phenomena that take place in the peridental membrane.

You have all heard him speak of granulomas. This mass is nothing more than a proliferation of connective tissue.

I wish I could discuss this scholarly paper in a better way, but I was not on the program, and had no opportunity to read this paper. However, this paper proves that when we have men like Dr. Hopewell-Smith come before our Society, it has a tendency to uplift orthodontia.

The President, Dr. Mershon. It is very plain to me, gentlemen, that it is possible for men to become too highly specialized and forget there is any other department except the one they are directly working on and interested in. We must remember as specialists that we cannot treat just one organ, nor deal with one particular part of an organ. We are concerned with mouth conditions at large. Dr. Smith has presented a phase of this subject in which we should be intensely interested.

I shall now throw the subject open for general discussion, and I hope the men will be prompt in speaking.

Dr. Milo Hellman, New York. It is of interest to notice in what manifold ways evidence can be obtained that may be applicable to the phenomena of greatest interest to an individual. In studies on growth in general, correlations may be made that add considerably to the appreciation of the interrelationship of various physiological manifestations. Thus it is a well established fact that the rate of growth reaches its highest expression during the fifth month in fetal life. From that time on there is a general decline until the period of pubescence. During puberty, growth is again accelerated, to be followed by a gradual but constant retardation.

These accelerations and retardations have been studied in correlation with various physiological manifestations. Thus, ossification of the carpus has been found to be in intimate relationship to growth as measured by height and weight. Also pubescence is closely associated with growth as are the processes of teething. In a recent study as presented yesterday before this society, I have found that occlusion stands in intimate relationship to growth.

Relation of Caries to Growth Periods.

From Dr. Hopewell-Smith's paper, I gather that also dental caries may be associated with growth. From figures kindly furnished me by Dr. Hopewell-Smith, it is evident that during the period of retardation in growth, there is an increase in dental caries. That is, there is an inverse correlation. Thus, from statistics collected by the British Dental Association about twenty years ago, the percentage of defective teeth of children between four and six years of age is about 76.2, increasing to 86.8 between the ages of seven to nine, when growth is at its lowest rate. With the acceleration of growth beginning at this age, there is a decrease in the manifestation of caries. Thus, between the ages of ten to twelve. the percentage of defective teeth drops to 83.9, and as growth begins to retard after puberty the percentage of defective teeth again rises to 85.9 at thirteen to fifteen years of age, and shows its height of 93.6 per cent. at the ages of sixteen to eighteen years.

Another point of interest to me was the graphic representation by Dr. Hopewell-Smith of the frequency of caries in the different teeth in the same mouths. As you have noticed in his diagram, the figures demonstrating the frequency of occurrence of such decay assumed the form of the curve of probability. In my talk to you yesterday, I explained that all biologic phenomena must conform to this figure if scientifically treated. It is, therefore, a considerable gratification to me to see my arguments supported by the essayist's scientific procedure.

Origin of Osteoclasts.

With reference to the origin of the osteoclasts. According to Guido Fischer, all manifestations in bone changes are preceded by a hyperemia surrounding the affected region. This hyperemia is affected by a considerable increase in the number of capillaries. The capillary vessel walls thereafter disintegrate, and the endothelial cells constituting them become independent cells, metamorphosing into osteoclasts. The extensive histological evidence brought out by Fischer is so convincing that it is difficult to depart from his views.

Effect of Hyperemia.

The effect of hyperemia in the oral cavity is of unusual interest when considered in relation to its effect on bone changes. As orthodontists, we are —or should be—greatly interested in the influence of normal and pathological oral tissues upon the character of bone changes associated with tooth movement. According to the experiments of Dr. Albin Oppenheim, the artificial movement of teeth is accompanied by structural modifications in the bone tissues surrounding them. These modifications are definite and characteristic of the tissues involved and of the force exerted. Thus, gentle and continuous force brings about normal histologic changes while excessive force produces pathological conditions without structural modification. Subsequent to tooth movement, there is a readjustment of the bone elements simulating previous conditions. But, although the bone spicules reassume their former orientation, there still remain areas of unossified bone surrounding them. Thus, by the assistance of a retaining appliance, the calcified portion exceeds the uncalcified zone, while when no retaining appliance is used, the latter preponderates. It becomes, then, a question of considerable significance to study these manifestations under anaemic and hyperemic conditions. The solution of future problems of the orthodontist will, in a great measure, depend upon a thorough knowledge of bone changes under physiological and the various pathological conditions encountered in the human mouth.

Principles of Retention in Orthodontia

By Calvin S. Case, M. D., D. D. S.

Read Before the American Society of Orthodontists, April, 1920, *Chicago, Ill.*

PRELIMINARY

It may be well for me to state that the paper which I am about to read does not pertain—except incidentally—to any form of technic retaining appliances or plates. Its main object is to present certain *principles* of regulating which I have found indispensable to the *permanent* retention of certain inherited dento-facial malocclusions. Particularly those in Classes II and III, in which are found pronounced disto-mesial malocclusions with protrusions and retrusions of one denture or the other.

The principal claims of the paper pertain to the inadvisability of extensive reciprocating disto-mesial movements of the entire dentures to a normal occlusion with the intermaxillary force. It advises instead, the movement of the buccal teeth to a perfect interdigitating masticating occlusion, and the correction of the facial outlines with the required movements of the front teeth alone.

If there is one part of orthodontia more than another that is absolutely indispensable to the success of this specialty and its establishment upon a firm foundation as one of the arts and sciences, it is the permanent retention of regulated teeth.

We may possess high ideals in regard to the relations which the teeth and dentures should bear to each other and to the facial outlines. We may be able with our facilities and chosen methods to move the teeth in a manner and to positions which fulfill all the requirements of our understanding of perfect correction; and we may be justly proud of the really wonderful results which we at times are able to accomplish. But after all, what does this temporary pleasure and satisfaction to ourselves and our patients amount to, if we find in a few years that the very cases which create in us the greatest pride, are going back to their former malpositions and disharmonies, in spite of everything we have been able to do with retaining appliances? Or if at the close of our operations proper we are conscious of the possibility and even probability of ultimate failure, judging from other similar cases that had been corrected in the same way, and with the same proposed methods of retention? This naturally leads one to lose confidence in the high ideals of his profession

The art of moving teeth in the correction of irregularities has been regarded in the past as so nearly the whole of orthodontia, that the retention of corrected teeth was largely considered a matter of course, and its importance, its difficulties, and its uncertainty of permanency were lost sight of, or regarded thoughtlessly as a very minor branch of the art of regulating. It is possible and even probable that the art of retention will never approach so nearly to an exact science as that or regulating, because of certain natural influences over which one can have little or no control. Yet it is neverthless a fact that the principal failures along this line have been and are largely due, first, to a lack of appreciation of the forceful influences of heredity; second, to a wrong system of regulating which leads to placing too much dependence upon the normal locking interdigitation of masticating cusps; and third, it has been due to inadequate retaining methods and appliances, and the unfortunate tendency among a large class of orthodontists to avoid everything which demands considerable personal training in high technical skill.

To be sure the occlusal interlocking of cusps and other harmonious relations afforded by a normal occlusion are of the very greatest importance to retention. This also is quite as important in those cases where a normal occlusion is not advisable, on the same principle that decidedly irregular teeth are often held in malpositions solely through the interlocking of the masticating cusps of abnormal occlusions.

And yet in no instance of regulated teeth can the most exact interlocking of masticating cusps be depended upon solely to combat the forces of heredity, or of even long standing malpositions which have involved a considerable maldevelopment of the alveolar process and maxillary bones. Therefore, we are dependent upon retaining appliances or fixtures which will hold the teeth in their regulated positions and completely combat the forces of reaction toward every character of regulated movement, until nature is given a chance to restore or build a new foundation around the roots, to stabilize their new positions.

If the movements in these cases have been extensive, involving a number of teeth side by side moved in phalanx, as in the linguo-buccal movements in arch expansion, or extensive disto-mesial shifting of the buccal teeth to normal occlusion, or if a whole or a part of the movements has been in the nature of bodily movement, *we are certainly up against a big proposition;* and a proposition, moreover, which we must successfully meet, or acknowledge that our profession of orthodontia is a failure, or at least that a large proportion of our most important and satisfactorily finished cases cannot be permanently corrected.

Importance of Permanent Retention.

One of the most prominent orthodontists of New York City said to me, in substance, a few months ago: that the practice of orthodontia was beginning to be feared by many of our best orthodontists as more or less of a failure. And when I asked him "why?" He said: "Because it is impossible to permanently retain a very large proportion of our regulated cases."

If this statement is true, coming as it did from one who is in close touch with the pulse of his profession, I must say that I regard it as one of the most healthful symptoms of our evolutionary progress that has arisen for many years in this department of dentistry. It shows in the first place, an appreciation of the indispensable importance of retaining the positions of our regulated cases permanently, not merely during the period of artificial retension, but in after years; and it shows also, that a very large proportion of orthodontists have deeply considered the seriousness of failures in this regard, and are not wholly satisfied with the retention of their previously regulated cases. Consequently, their minds may be open for a through study and possible application of some of the principles to which I am indebted for the correction and permanent retention of a large proportion of the most pronounced dento-facial disharmonies in my practice.

I believe it will be found that there are no easy winding paths that will reach that goal of permanency in retention of regulated teeth, or any sure paths which will not at times shatter the radical insistence upon long conceived ideals which have been and are regarded by many, as the most indispensable and unswerving principles of orthodontia.

If we have arrived at that stage in our progress when we fully appreciate the fact that permanency in the correction and retention of our regulated cases is the most important factor in orthodontia, and if it is a fact that in the advancing demand sof bodily and other extensive movements which have increased the difficulties of retention, that a large proportion of orthodontists are not fully satisfied with the final results in many of the most pronounced dento-facial malocclusions in their practice, then I think it is time to at least modestly ask if it would not be well for us to stop and deeply consider some of the underlying principles of this subject of retention from the broadest possible view point, and in doing so, to lay aside our petty partisan prejudices and get together as in a League of Nations, that the world may be benefited.

Difficulties of Permanent Retention.

I think it will be admitted that our greatest difficulties in permanency of retention are found among the very cases which seem to be the most necessary to correct. I refer to those decided disto-mesial occlusal malrelations of the buccal teeth in Classes II and III in which are found those pronounced dento-facial protrusions and retrusions which we are always more than anxious to permanently correct.

In Class I malocclusion, in which by far the greatest variety of irregularities arise, nearly all are due to some one or more local cause which has attacked what otherwise would have been normal occlusions, and consequently demand that the dentures be restored to the normal relations which nature intended they should occupy. In all corrections of that kind, permanency of retention can be assured, if a proper quality and degree of artificial retention is employed.

But with Classes II and III, the difficulties are greatly increased, because of the fact that the dento-facial malrelations pertain to the entire upper or lower or both dentures, the buccal teeth as well as the front teeth supposedly demanding, according to the commonly practiced system, that the entire dentures be shifted disto-mesially to a normal occlusion, which can usually be accomplished with the intermaxillary force at almost any age.

If I may be pardoned in presenting a few previously published illustrations of former papers, I should like briefly to refer to some of the difficulties and failures of retention in my early practice of orthodontia as a specialty, which caused me to change my tactics in regard to treatment, and would have caused me to go back to the general practice of dentistry, had I not also discovered in this connection the retaining system which in its developed state has proven a godsend in my practice.

The Author's Early Experience.

In the winter of 1891 and 1892, I commenced the exclusive practice of orthodontia in Chicago. Previous to that, for nearly twenty-five years, I was engaged in the general practice of dentistry in Jackson, Michigan. During the later years of that time I had gained quite a reputation as an orthodontist through papers which I had read before prominent societies. I had even given a clinic before the First District Dental Society of New York City on "the Angle System of Orthodontia," and I had also presented a paper published in the *Dental Cosmos* in 1890 in advocacy of that system, as opposed to the system of regulating plates. It was a paper which I read before the Illinois State Dental Society entitled, *"Orthodontia,"* that secured me the appointment to the chair of Prosthetic Dentistry and Orthodontia in the Chicago College of Dental Surgery in 1890. During the many years of my early practice, and for a few years after I had started in Chicago, whatever the method employed for the regulation of the teeth, the main retainers were black rubber plates

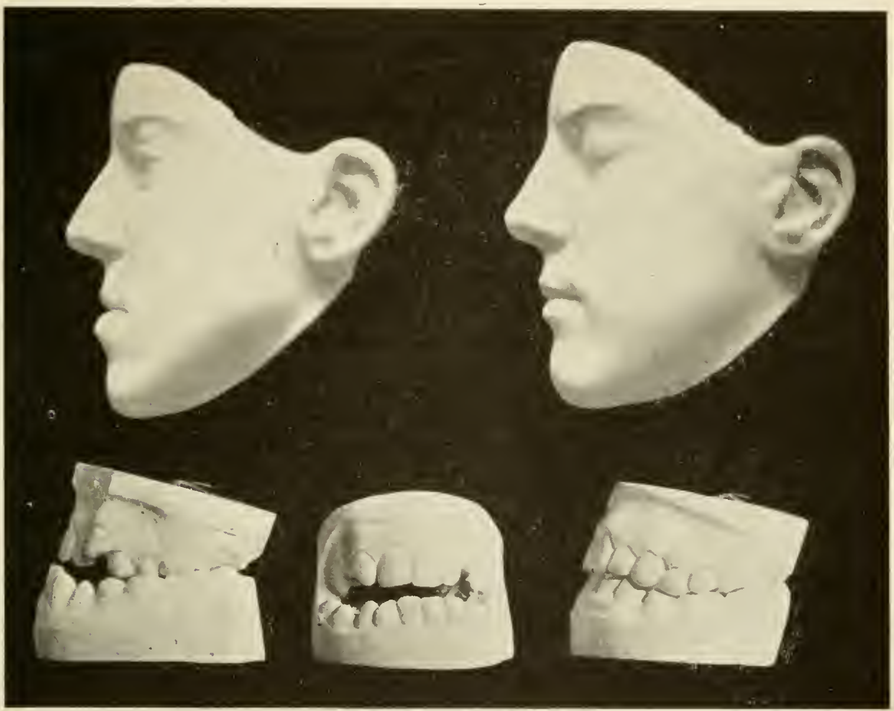


FIG. 1

with nicely fitted interproximate extensions and often with German silver spurs and wire labial bows vulcanized into the plates to exert special retaining forces.

During the first year of my practice in Chicago, there fell into my hands four notable cases of dento-facial malocclusion, consisting of three pronounced cases of upper retrusion, and one upper protrusion. Out of the demands which arose in these cases, arose the practical disto-mesial application of the intermaxillary force, and the bodily movement of teeth. One of these cases in a supposedly finished state was described in a paper read before the Chicago Dental Society, February 2, 1893. It was illustrated with plaster dental and facial casts, and with appliances; all of which were published in the following March number of the *Dental Review.* See Fig 1. The other three cases in a more or less finished state were described in connection with this first case in a paper read before the International (Columbian) Dental Congress the following August (1893). They were illustrated with plaster dental and facial casts mounted in black velvet lined cases. Figs. 1, 2, 3 and 4, which will be referred to later, were published in the Proceeding of the International Dental Congress of 1893, and in the *Dental Cosmos.*

In the rush to get these cases finished before the meeting, I was obliged to present two of them (Figs. 2 and 4) before the teeth were fully in place.

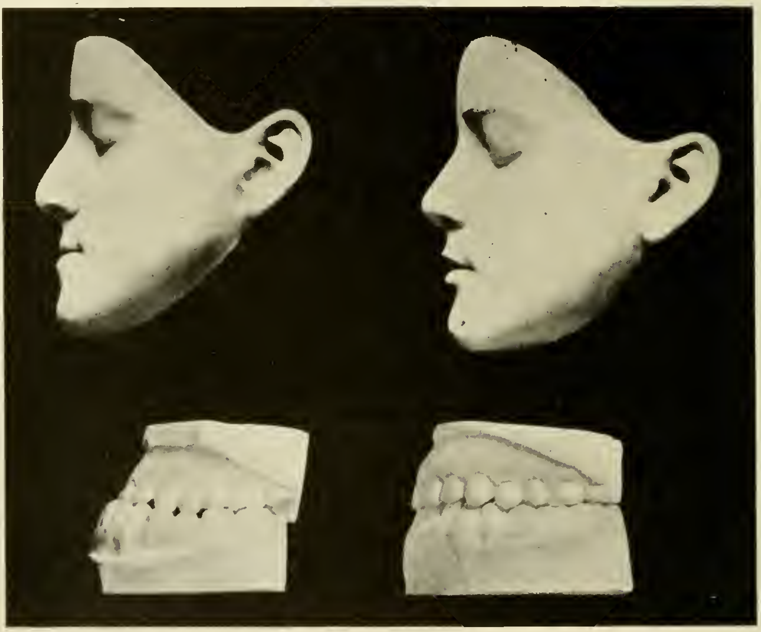


FIG. 2

The Class III malocclusion shown in Fig. 1 represents the plaster cast of a Miss thirteen years of age at the beginning of the operation in 1892. The dento-facial malocclusion was caused partly by heredity, but mostly by adenoids and long continued habit of mouth-breathing in early childhood years, resulting in a contracted maxilla and open-bite malocclusion. The treatment consisted in an expansion of the upper arch, a bodily labial movement of the upper front teeth, and a protrusive movement of the entire upper denture (the latter produced without my realizing it) through the reaction of the intermaxillary force which at the time was intended only as an auxiliary to a lingual movement of the lower front teeth, and for stabilizing the upper single-band anchorages. I speak of this here as a matter of history to show that I did not realize before its application in this case, the forceful influences of the intermaxillary elastics toward a disto-mesial movement of entire dentures. In cases which immediately followed this, however, its mesio-distal action was planned for at the start and taken too much advantage of, which I found to my sorrow later, because it showed me the danger to permanency of retention by extensive disto-mesial movements with this form of force. Subsequently, I pointed this out in some of my early writings as a warning to other orthodontists whom I feared were over-

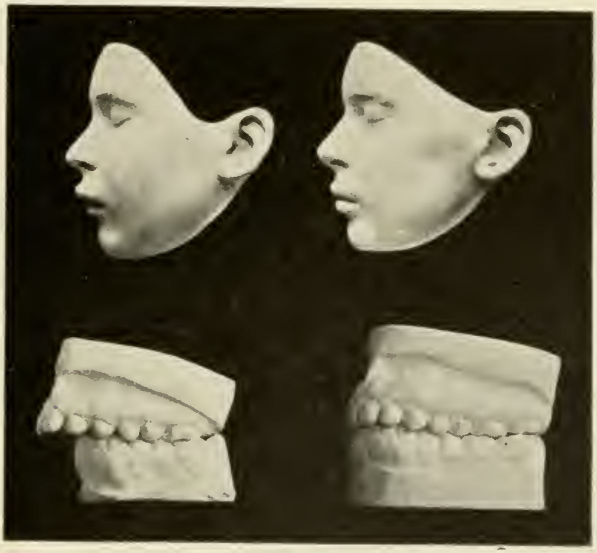


Fig. 3

working this method as I had done. It is that same danger of the over-employment of the intermaxillary force which I now again wish to warn you against in its relation to the subject of permanency of retention.

The second case, a Class III malocclusion also, shown in Fig. 2, from the model of a Miss fourteen years of age, was caused wholly by heredity. Her father and her brother were both afflicted with the same character of dento-facial malocclusion. The treatment, besides the bodily labial movement of the upper front teeth, consisted in disto-mesially shifting the dentures with the intermaxillary force toward a normal occlusion. As I said before, this case was not fully corrected when shown at the meeting and as published in the Proceedings. The figure illustrates the final position of the dentures several months later when a normal occlusion was fully established. Then commenced the fight for permanency of retention, as in the other case, but which I am now sure, would not have been possible, regulated in that way.

The third case a Class II malocclusion shown in Fig. 3, from the models of a Miss about thirteen years of age, was also due to heredity, evidenced by other members and relatives of the family, though perhaps enhanced over the labial area with the thumb-sucking habit. The treatment in this case consisted in opening the bite by an extrusive movement of the buccal teeth. This enabled a retrusive movement of the upper front teeth, and ultimately the entire upper denture mainly with the intermaxillary force, and—what goes without saying—it also produced a protrusive movement of the entire lower denture. When I had succeeded in closing the wide interproximal spaces between the upper teeth, I found that the facial outlines were so improved, I concluded to present this case in this condition at the Congress with the others; a thing I had not expected to do, because I regarded it as only about half finished at that time; my intention being to place the teeth ultimately in normal occlusion. The facial casts here shown are the same as those published with the Congress paper. The impressions for the final dental casts with the teeth in normal occlusion were taken about one year later. Unfortunately, I did not take a final facial impression.

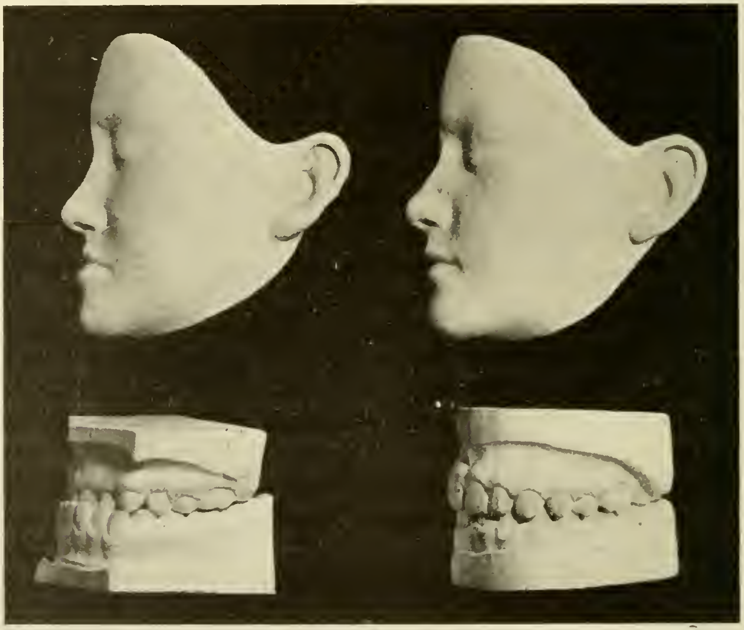


FIG. 4

I had learned by this time (1893 and 1894) that it was a very easy matter to shift dentures to a normal occlusion with the intermaxillary force. And, as I said before, I also learned some years later that this is a dangerous expedient in nearly all cases where an extensive disto-mesial movement is demanded. First, because of the improbability of permanency of retention, and second, because in a large proportion of these cases the best facial results cannot be obtained in that way.

I have brought these three cases to your attention to give evidence that in every one of them, and in a number of similar cases that followed, I was unable to finally retain the dentures and the facial outlines in their corrected positions.

The fourth case—that of a Miss thirteen years of age—shown in Fig. 4—was a Class I malocclusion. The retruded malposition of the upper incisors was due to a local cause, and when corrected with a bodily labial movement, it was easily retained, because no disto-mesial movement of the buccal teeth was required.

The reason for the many failures in permanency of retention in my early practice was partly due to the fact that we had no reliable system of retention at that time, and especially no appliances adapted for the retention of bodily movements. The principles, importance, and difficulties of retention were in their infancy in orthodontia. And yet, though lacking as we all did in those days, in a full appreciation of the importance and difficulties of rtention, I had been employing for years everything that an ingenious mechanical mind could suggest in the form of retaining plates and appliances, but nearly always in futile attempts to retain the teeth in cases that were corrected by an extensive disto-mesial shifting of the dentures to normal occlusion, and with no more chance than a rabbit in the retention of bodily movements.

After five or six years of discouraging experiences in attempts to retain the corrected positions of all pronounced disto-mesial malrelations of the dentures, which arose from heredity, I gradually developed and adopted my present system of retention, and also stopped all extensive disto-mesial movements of the buccal teeth to correct *upper retrusions and upper protrusions,* except in the comparatively few cases whose peculiar conditions demanded the other treatment. But unfortunately, I did not adopt this method at that time in the correction of *lower retrusions.* I was, however, coming to the conclusion which I hold today, that all inherited, and even long acquired disto-mesial malinterdigitations of the masticating cusps present conditions that should be disturbed with great caution if at all, except to adjust the occlusion, and especially with no extensive *distal* movement of the buccal teeth, upper or lower, except in those cases in which the first permanent molars have drifted forward through premature loss of deciduous teeth, or from other local causes.

Since that time, all extensive retrusions of the upper denture in Class III malocclusions which arise from heredity, have been corrected

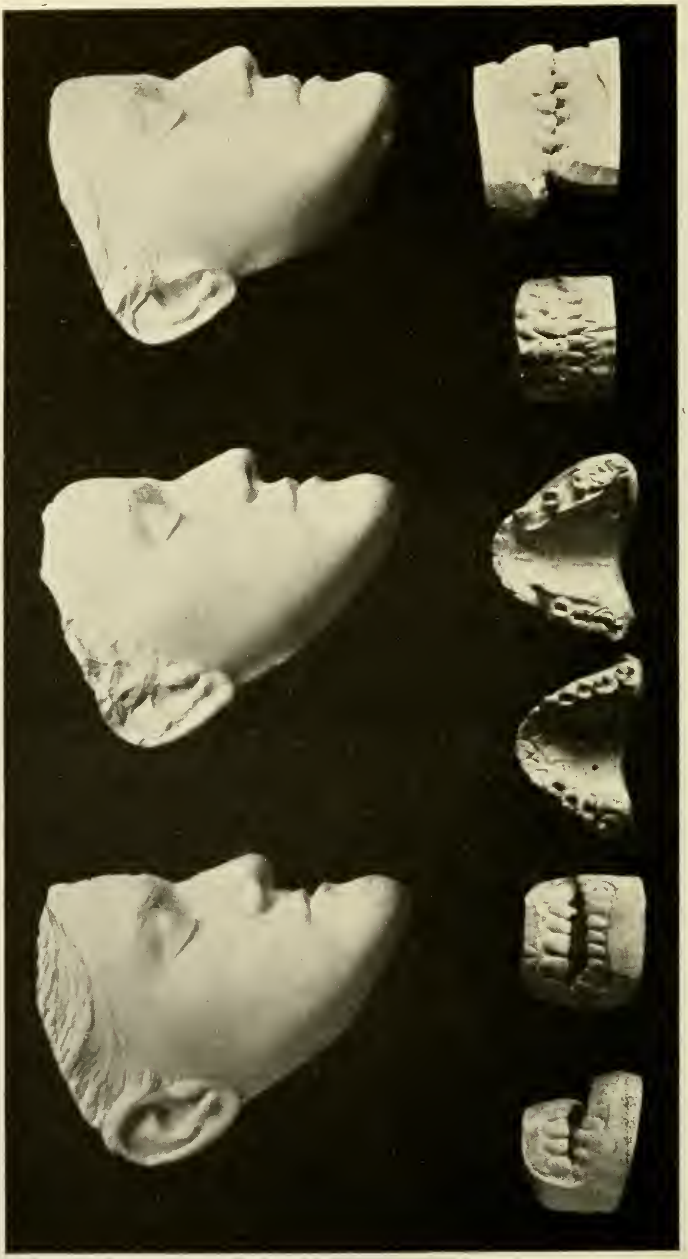


Fig. 5

in my practice—not by moving the entire upper denture forward—but by a bodily labial movement of the *front* teeth only, thus opening spaces in the bicuspid area for the insertion of artificial retaining teeth. See Fig. 5. In these cases, if the lower dentures are protruded, they are corrected through extracting the first bicuspids preferably, except when the second bicuspids or first molars are badly decayed.

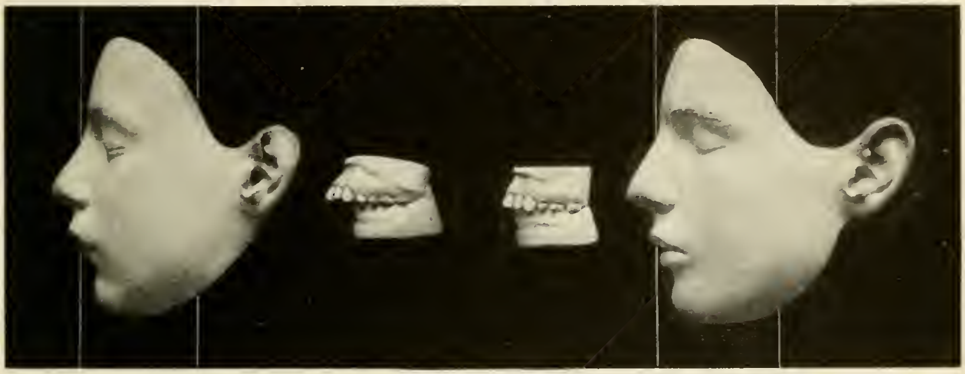


FIG. 6

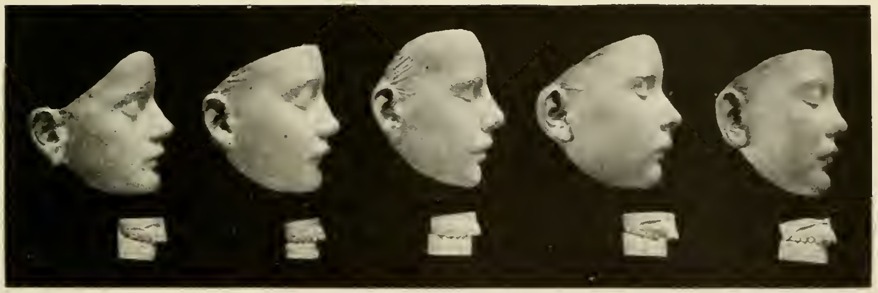


FIG. 7

In accord with these same principles in the correction of all inherited upper protrusions of Class II, in which the lower dentures are in normal dento-facial relations, I have for years in my practice extracted the first upper bicuspids preferably, followed, as shown in Fig. 6, with a retrusive movement of the six upper front teeth; which commonly is about the only movement to speak of that is required; the buccal teeth frequently being already in an inherited or established malinterdigitating occlusion, and quite as useful for masticating purposes as a normal occlusion. I adopted these principles in my practice, because I found they enabled me to give to my patients good masticating occlusions, a correction of deformed facial outlines, *and a permanency of retention which I could not obtain in any other way.*

Note: Figs. 6 and 7 by courtesy of Dental Cosmos.

Previous to this change in my practice, in nearly all cases of Class II in which there was a pronounced protrusion of the upper with the lower normal, there was an endeavor to place and retain the teeth in normal occlusion with the intermaxillary force, as shown in Fig. 3, but frequently with a most unsatisfactory dento-facial result, because the upper was only partially corrected, and the lower was abnormally protruded to the same extent or more, leaving the patient with a prominent mouth, indicating a partial bimaxillary protrusion, and what was worse, impermanency of retention.

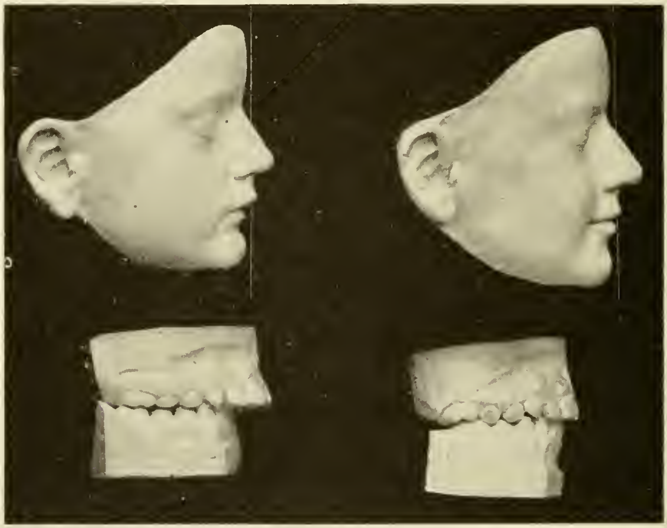


FIG. 8

There is another division of Class II malocclusion which is quite as distinctive and perhaps more common than upper protrusions, and though having the same general occlusal malrelations of the dentures, it decidedly differs from it in facial outlines and demands of treatment. The extreme type of this division as shown in Fig. 7 is characterized by a pronounced retrusive malposition of the entire lower denture in relation to the mandible and to a normally posed or nearly normally posed upper denture, and commonly it is associated with a close-bite malocclusion. Facially, it is usually characterized by a decided retrusive deepening of the labiomental area in relation to the chin and a normal or nearly normal position of the upper lip.

Between the two extremes of upper protrusion and lower retrusion of Class II, lie every gradation of dento-facial relation within the class.

the composite of which is a moderate upper protrusion in connection with a moderate lower retrusion.

I am particular to fully outline this character—which no doubt is familiar to you—because it has always been, except in recent years in my practice, the *bête noire* of all my efforts in permanency of retention; and I thought possibly it might have been the same with you. With me, the main reason for this lengthy series of failures in this malocclusion, was because I was loath to admit that this particular character could not be permanently corrected through the normal occlusion route, as shown in Fig. 8, until one ultimate failure after another continued to stare me in the face. In other words, I treated it along the same lines which characterized my very early practice in correcting *upper* retrusions, believing that pronounced lower retrusions also required an extensive protrusive movement of the *entire lower denture*—of course with a bodily labial movement of the front teeth. Then commenced the usual unsatisfactory endeavor to retain the disto-mesial relations with a moderate continuation of the intermaxillary elastics. But always or nearly always, with the same ultimate heart-rending result of seeing one case after another return to its former malocclusion and facial imperfection, after the retaining appliances were removed.

The illustrations here shown, represent only a very few of the many cases with this special character of malocclusion, which was corrected in my earlier practice by placing the dentures in normal occlusion. Nearly all cases of this character that were corrected in this manner, and for which treatment commenced in a number of instances at eight and ten years of age, I regret to say, have drifted back to their former malpositions; through for years I continued a moderate application of the intermaxillary elastics.

At last, about five or six years ago, I fortunately had the sense to adopt the same principles of treatment in the correction of *lower* retrusions as that which for years had enabled me to permanently correct *upper* retrusions. In this proposed method of treatment there is no attempt to extensively change the disto-mesial relations of the buccal occlusion, except to correctly adjust the linguo-buccal and disto-mesial interdigitation of the cusps. The main treatment consists briefly, in a bodily labial movement of the lower incisors, carrying forward the cuspids and first bicuspids, partly through the reaction of the fulcrum arch bow, thus opening spaces for the insertion of artificial retaining bridge teeth, between the bicuspids. The separation of the bicuspids, or of any teeth for the insertion of artificial teeth, or the closing of spaces where teeth have been extracted, is always accomplished in my practice with bodily movements, enabled through the advantages of rootwise extensions—fully published in other places.

The retention of the bodily labial movements of the incisors, and the inclination or the bodily movements of the cuspids is secured with the usual six-band retainers supporting the lingual iridio-platinum springs bars; a description of this is also fully published. When this appliance is finally removed after being worn about two years, the teeth are prevented from returning to their former malposition because of the sustaining force of the bridge dentures. This method results in an equally artistic correction of the facial outlines, and insures permanency of retention without materially changing the inherited occlusion of the buccal teeth.

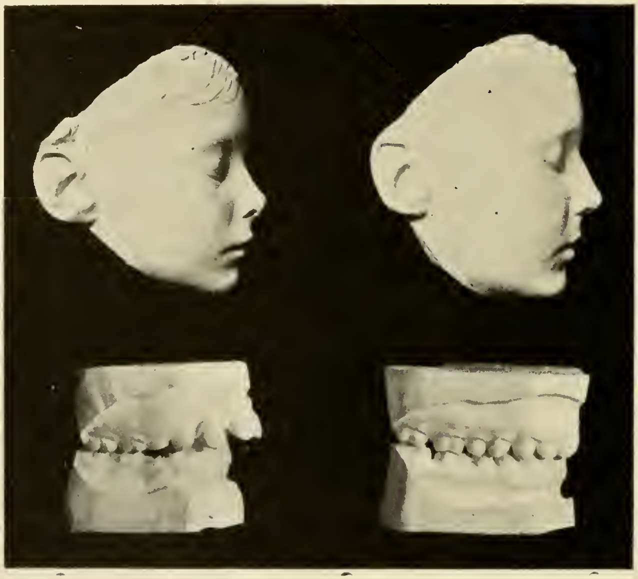


Fig. 9

Two cases of twin brothers commenced at twelve years of age, I will now show to illustrate this principle. These cases were practically exactly alike, being typical retrusions of the lower dentures in relation to the mandible, with close-bite malocclusions; therefore, they presented a most favorable opportunity to test the comparative value of the two methods of correction. That shown in Fig. 9 was corrected by shifting the dentures as formerly practiced in these cases, to a normal occlusion with the intermaxillary force, being careful to produce a much greater mesial movement of the lower than a distal movement of the upper.

That shown in Fig 10, was corrected, as shown, by a bodily labial movement of the six lower front teeth; the first bicuspids being carried forward by the force of the fulcrum bow of the apparatus, and through the advantage of rootwise attachments on the bicuspids. Now that these spaces are permanently secured in this case with extra bridge bicuspids, there can be no doubt of permanency of retention. Whereas, in the other case, like many others corrected in the same manner, permanency of retention cannot be assured.

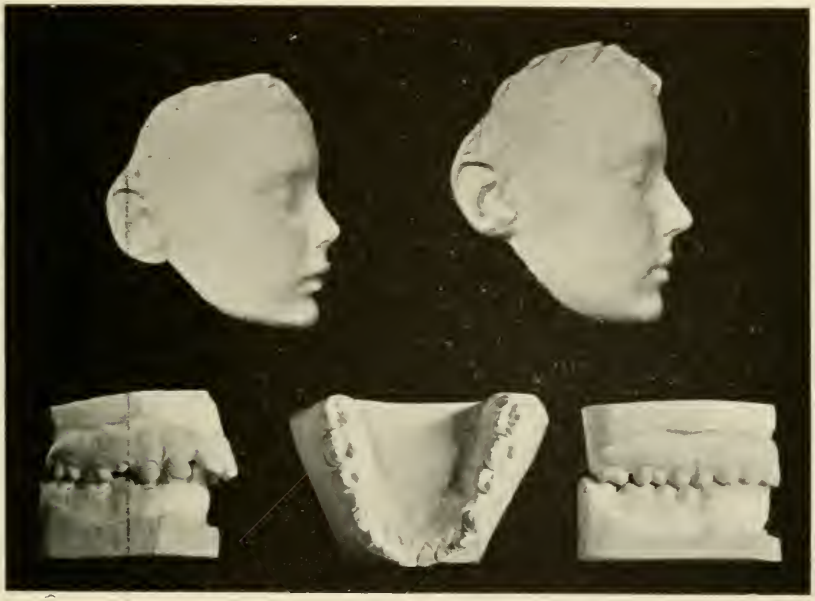


Fig. 10

It is not usually a difficult operation to shift disto-mesial malocclusions of Class II—in protrusions of the upper and retrusions of the lower—to a normal occlusion with the intermaxillary force, provided there are no pronounced complications, and particularly in those cases where an evenly disposed reciprocal force may be employed as often arises. Neither is it beyond the reach of most orthodontists to obtain beautiful results at the close of operations in this particular type, by this method, even where considerable complications arise. But that is not the whole question which should be considered in the advanced practice of orthodontia of today. Many of these cases in my practice, and I dare say hundreds of similar cases in the practice of this specialty, have not retained the perfect positions shown by the finished results, even after being artificially retained for two years or more with the most approved retaining appliances. Why? Because the entire upper and the entire lower dentures have been moved backward and forward of their inherited positions in the jaws, and particularly because there are no stationary means of anchorage by which they can be reliably held in the corrected position until nature can establish their permanency of retention, which I doubt would *ever* be possible.

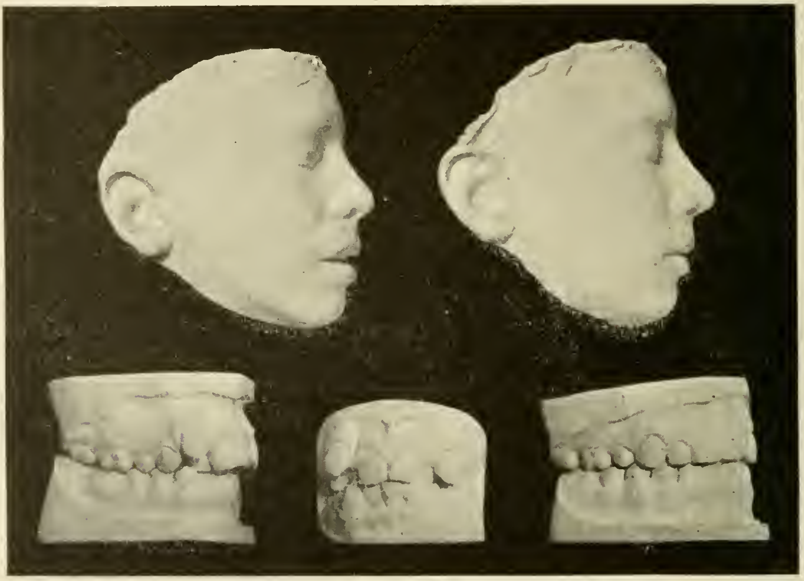


Fig. 11

I believe that a very large proportion of the failures in retention among the orthodontists of today is not due to the inadequacy of the retaining appliances they have employed, as much as it is to the radical application of the system which demands that all regulated cases *must* be placed in normal occlusion. This must frequently place the teeth in relative dento-facial positions which no kind of appliances or plates that ever have been, or ever will be invented, will prevent them from returning partially or wholly to their former malpositions, after the artificial restraint is removed.

The Normal Occlusion Dogma.

Before leaving this subject, I must beg your indulgence for a few moments in a little wider consideration of the radical formula that "*in all cases* the dentures should be placed in normal occlusion without the loss of a single tooth or its substitute." I believe that the day is not far distant when that teaching and its invariable application will be regarded as one of the great retarding forces of orthodontia, and in its place will come a rational scientific common sense orthodontia, stripped of all impractical imperialistic idealisms.

I believe that this formula and its *impossible* assertions in regard to its correction of the facial outlines has been in the past, and is today, over-worked by hundreds of good men in orthodontia to their own detriment and the detriment of their patients.

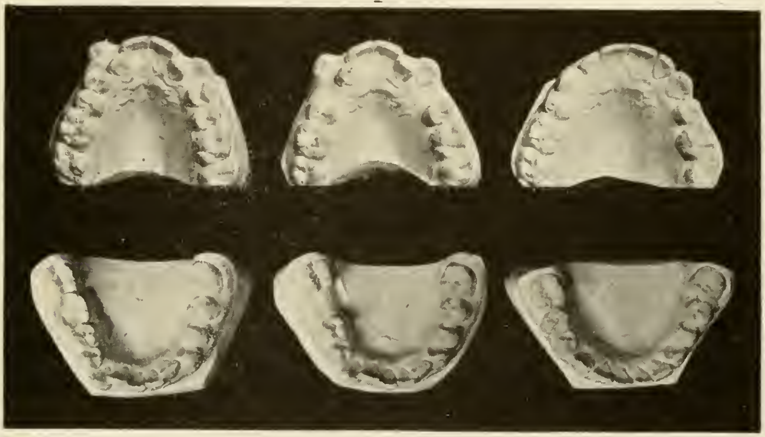


FIG. 12

As one of the many illustrations of this that has fallen under my observation, a family of very moderate means consulted an orthodontist of high reputation, of conscientious ability, and a friend of mine, in regard to the correction of their son's teeth, who at that time was twelve years of age. The prominent feature of the case was a deforming maleruption of the upper cuspids, in a mouth which distinctly indicated an inherited upper protrusion, shown by the mesial malocclusion of the upper buccal teeth in connection with a normally posed chin and lower lip, and proven by a similar malocclusion in one of the parents. The straining force of the upper lip—after a premature loss of deciduous teeth—had caused the incisors to drift back and nearly close the spaces for the normal eruption of the unusually large prominent cuspids. One of the complications of the case was a decayed and broken-down condition of the right lower first molar, in which the pulp had long since died and was in a putrescent condition, and had previously given trouble from symptoms of an abscess.

I was told that the treatment outlined by the said orthodontist was to place the dentures in normal occlusion and restore the molar with a crown. I think you will agree with me that this is the same principle of treatment that has been strictly followed in the past by many orthodontists, and I believe it unfortunately is still followed by many who earnestly believe it to be the true principle in the correction of all malocclusions.

The case fell into my hands because of the prohibitive fee; this led the father to inquire if it could be corrected at the college. It is needless to say that the extraction of the two upper first bicuspids was ordered by me. This gave very little more room than necessary for the eruption and alignment of the cuspids. The diseased lower molar was also extracted, as in my opinion, no capable dentist in these days would attempt to save it.

With the exception of appliances for the bodily mesial movement of the second molar to take the place of the extracted first molar, the case no doubt would have corrected itself without any regulating appliances, if given time under ordinary circumstances. It was hastened with an upper apparatus having a light resilient arch bow for the alignment of the cuspids, and with the intermaxillary force to aid in the mesial movement of the molar, and adjust the occlusion.

Fig. 11 shows the facial and dental models of the case at the beginning and completion of the operation. One can see by a careful study of the facial outlines at the beginning, that the lower denture was not retruded dento-facially, and therefore, had the upper cuspids erupted in alignment it would have been purely an upper protrusion. Consequently, to say nothing of the diseased lower molar, the only way that the facial outlines could have been corrected would have been by a retrusive movement of nearly the entire upper denture fully the width of a bicuspid. But what would have been done probably, as in many similar cases, both dentures would have been moved disto-mesially, possibly with more of a protrusive movement of the lower denture than a retrusive movement of the upper, inevitably resulting in a partial bimaxillary protrusion of the upper and lower labial area.

Fig. 12 shows the case from the occlusal aspect.

The whole subject of orthodontia in its relation to the treatment of those pronounced dento-facial protrusions and retrusions of Classes II and III—to say nothing of the deforming bimaxillary protrusions in Class I—resolves itself, it seems to me, into the question: which is the higher professional attainment for our patients and ourselves, to produce for them in the regulation of these cases an absolutely normal occlusion of the dentures with the improbability of permanency of retention, and the possibility of an ultimate deforming dento-facial imperfection; or, on the other hand, to produce an occlusion of the dentures which fulfills all the requirements of healthful mastication, and results in a correction of the dento-facial disharmony; with a permanency of retention which cannot be equally assured in any other way?

Finally, I hope that no unthinking mind will misconstrue the objective principles of this paper, or imagine for a moment that it refers to any dental irregularity however jumbled or malposed, which can be perfectly and permanently corrected without extraction. Because it has reference only to a comparatively small part of the malocclusions which arise in practice, but whose correction and permanency of retention are of the greatest importance, because they produce the greatest dento-facial imperfections and deformities which the orthodontist is called upon to correct.

Furthermore, I do not wish to be understood as assuming that I follow the outlines of this treatment in *every* case, nor that I *invariably* secure permanency of retention with my very best efforts, so much depends upon the forceful influences of heredity and a perfect co-operation on the part of the patient.

In the short time allotted to a paper it is impossible for me to even touch upon many co-ordinate subjects in causes, diagnosis and technics, which I fully realize are of the very greatest importance to a successful application of the principles I have outlined.

In giving you this brief synopsis of many years of clinical experience in the treatment of certain dento-facial malocclusions which I have found the most difficult to permanently retain, it is hoped that the practical application of these principles will be of the same benefit to others as it has been to me.

Discussion of Dr. Case's Paper

Dr. F. M. Casto,
Cleveland,
Ohio.

The essayist has well said, that the retention of regulated teeth is indispensable to the successful practice of orthodontia.

There are many factors that enter into the question of retention, some of which are, diagnosis and treatment, age, function, harmony in size of the arches, occlusal relations, interproximal contact, etc.

When a case presents to the orthodontist, a thorough, careful, and sane diagnosis should be made, anticipating in so far as possible the ultimate permanent retention. The diagnosis should consist in accumulating all data that is pertinent to the case, a just and fair consideration of the same, and a decision made in accordance with good common sense and from a practical and operative standpoint. Ideals must never be sacrificed for methods, nor procedures detrimental to the best interests of the case, but empiricism should be frowned upon.

The treatment should be consistent with the requirements of the case, no more or no less. Overtreatment should be religiously avoided. The reasons are obvious. The kind or types of appliance to be used are only incidental, provided correct principles are embodied within them and they are properly managed; otherwise the final or permanent retention becomes a serious question.

Dr. Rogers has been able successfully to correct and retain certain types of malocclusion without the use of any appliance. When this can be done, it is much to be desired.

The adjustment and operation of the appliances is important and significant. Great care should be exercised not to injure the peridental tissues, nor to produce and maintain traumatic occlusion over a long period. The physiological processes should not be disturbed by the careless or unscientific application of force. It is my personal opinion that the majority of failures in retention may be attributed to faulty diagnosis and treatment.

Diagnosis, treatment, prognosis and retention are governed almost entirely by the age at which orthodontic interference begins.

The question of extraction is practically never considered if the orthodontic operation is begun early enough. The establishment of occlusal relations and the permanent retention becomes very much simplified in such cases.

Requirements of Retaining Appliances.

The function of the mouth and teeth should be kept to its highest degree of efficiency during the entire operative and retentive period. The mouth and teeth should be kept clean and healthy. These are fundamental principles without which the greatest success cannot be attained either in treatment or retention. Any appliance or treatment that interferes with this plan must be absolutely avoided. In this connection I wish to state that a retaining appliance should allow of mobility of the teeth, should consist of as few bands as possible, and should be of the removable or semi-removable type in all cases where indicated or where possible to be used.

The bands should be removed occasionally and left off for a few days in order to give the teeth a chance to breathe and to adjust themselves more or less to existing conditions.

Possible Dangers to Enamel.

The question has never been satisfactorily settled as to whether or not the enamel of the teeth is rendered more susceptible to the attack of micro-organisms when bands have been worn for a long period, during which time the teeth were being deprived of their natural environment.

Some authorities claim that the enamel can only be kept in a normal state of health and resistance by being bathed in saliva, arguing that since it is a normal physiological condition it must, therefore, be a beneficial one. I think incidents have been called to the attention of most of us where the resistance or vitality of the enamel was apparently lowered after the removal of bands and appliances that had been worn a considerable time. Research and clinical observation of this problem would be most appropriate and beneficial.

Maintenance of Function.

The ultimate success of retention, whether controlled by natural or mechanical forces, will depend finally, upon the establishment and maintenance of function.

The fact that harmony in the relative size of the arches must be established as a principle of retention is not debatable, nor is its necessity unknown to any of you. However, the manner in which this may be done is debatable, and has a most decided bearing upon the retention of certain cases of malocclusion, some of which have been pointed out by the essayist.

There are certain fundamental principles in orthodontic practice upon which we can all agree:

First—To remove the cause or causes when possible.

Second—To render only such orthodontic service as is necessary for the correction of a given case.

Third—To move as few teeth as will bring about the desired result.

Fourth—To influence teeth to erupt into correct positions rather than move them into such positions after eruption.

We also know that occlusal relations established by natural forces and maintained for several years although abnormal mesio-distally, will always be retained as such.

These principles are pertinent to the question of retention, and are concerned in the treatment and retention of certain cases presented by the essayist.

Extraction of Teeth.

With these things in mind then, the question naturally arises, whether or not, considered both from the standpoint of treatment and retention, it is ever advisable or permissible to extract permanent teeth in the correction of malocclusions. Pardon me, but I do not, at this time, intend to discuss this momentous question. However, I do wish to call your attention to the fact that Dr. Case has demonstrated by the presentation of several cases that his diagnosis and treatment were based upon sound judgment.

It is needless to remind you of the great importance and of the utter dependence for retention of the teeth upon the occlusal relations. It matters not by what man or method, or whether by witchcraft or science the case be treated, if certain definite incline occlusal relations are not established, the case will be doomed to failure. Mechanical retention will avail nothing.

The conservation of approximal contact is also necessary to the final retention. Loss of contact or abnormal contact will render the adjacent peridental tissues susceptible to disease because of injuries to them from the excursions of food in the act of mastication, and from the further fact that severe traumatic occlusion may be produced by food packing between the teeth. If this occurs, and is not corrected, the retention, in fact the entire orthodontic operation, will ultimately be a failure.

Heredity.

I do not wish to discuss the question of heredity as related to the problem of retention, except to say that in the light of present knowledge I do not believe it has very much influence. I do not think that any particular type or class of malocclusion is due to heredity any more than are other physical abnormalities, such as, for instance, club-feet or bow-legs, but I am almost convinced that practically all cases of malocclusion occur after fecundation or fertilization of the cells, and are the victims of circumstances during development, which includes the congenital as well as the pre-adolescent period, the perversions being due principally to function and environment.

I have purposely avoided the discussion of appliances and technic, because, as I said before, they are to my mind only incidental when compared to the real fundamental principles of retention.

Dr. Case has presented many things that give us food for thought. He has very kindly come here and given us of his valuable time and knowledge, and I wish to take this opportunity to personally thank him. I also wish to thank him for sending me a copy of his paper several weeks ago.

Dr. C. A. Hawley, Washington, D. C.

With many of the things Dr. Case has said in his introduction in regard to the necessity of permanent retention I can heartily agree. To the intimation or presumption which is carried through the first part of the paper, that the work of a large number of the leading orthodontists of the country is failing because of the failure of their retention, I most emphatically protest.

He quotes the opinion of a "prominent New York orthodontist" in support of this implication that much of the work of orthodontists is a partial failure, yet neglects to quote the authority on which this statement is made. It seems to me that if this statement is to have any weight at all the name of the author should be made known. It places every prominent orthodontist in New York under the suspicion that he considers his retention a failure, and we do not know whether it was a chance remark in regard to some feature of his own practice or the serious statement that is implied.

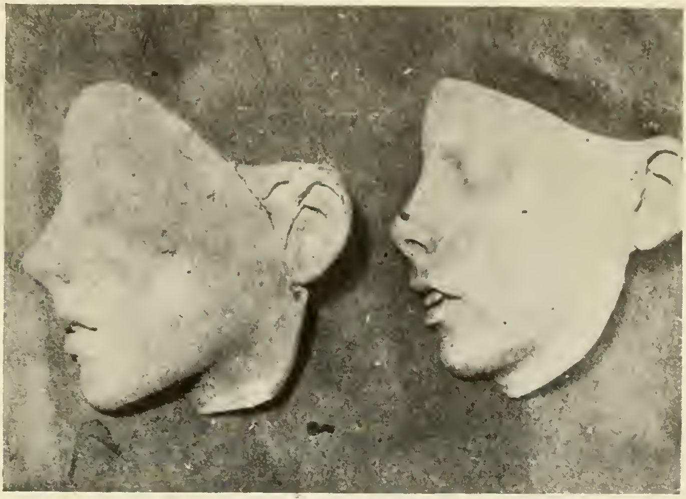


Fig. 1

Considerable has been written in the last few years about retention—about the difficulty of retaining some details of the treatment—as, for instance, the exact overbite; the exact width of the arches; the rotation of certain teeth, etc.; but nowhere have I seen an intimation of any considerable failure in retaining the main, important features of the treatment, and nowhere have I seen any references to failure in retaining the mesio-distal relation. Since receiving this paper, I have asked a number of prominent orthodontists, if they were having any especial difficulty in retaining the mesio-distal relation and they all replied "No."

Does the failure to retain all the details of many cases mean that the work of orthodontia is a failure? I do not think so. In fact, I believe that the majority of orthodontists have been able to correct and retain the main, important features of their treatment and that their work is a success. I do not believe that the practice of any branch of dentistry or surgery has so large a percentage of satisfied patients, and the universal success of the majority of orthodontists in the country all testify to the success of orthodontia.

Extraction in Class II Cases.

Dr. Case has for twenty-five years recommended and practiced the extraction of teeth in a certain number of Class II and Class III cases, or cases where the mesio-distal relation of the teeth has not been normal. What has been called by Dr. Case and others, "the New School of Orthodontia," has protested against this practice as unnecessary. Dr. Case seems to think he sees in the recent discussions of retention, and in the opinion he has quoted, signs of failure in retention of the mesio-distal relation, and advises that the whole trouble is in the treatment. In this I believe he is entirely mistaken. The failures in retention as quoted do not refer to these classes of cases more than any others, and in the instances where it does the trouble is becoming more clearly understood, and it does not, so far as I can see, relate to the manner of treatment. I think we are finding some reasons why the retention fails and some of these have been previously pointed out.

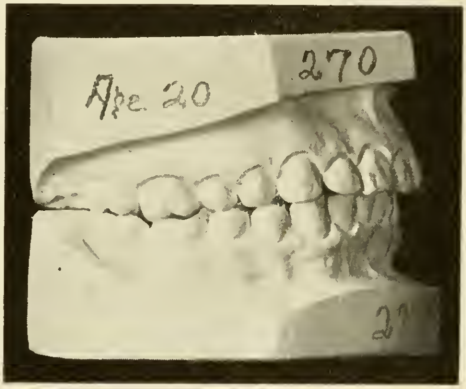


Fig. 2

I believe the teaching of extraction leads to great harm in the hands of inexperienced men. For example, if you will pardon personal reminiscence, I will say that I heard one of Dr. Case's first papers twenty-five years ago and was much impressed by it. It was shortly after I graduated (ten years before I took up the study of orthodontia seriously), and I went home and attempted to treat a case in that way. I find that I still have photographs of the face masks (Fig. 1). This treatment was a mistake and not an example of what Dr. Case would call a correct application of his principles, but a mistake young men frequently make in trying to follow the doctrine of extraction. This appearance of the obtuse angle between the nose and upper lip has been with me like a nightmare ever since, and has checked any desire to adopt this plan of treatment unless I could be sure of the results.

During all the seventeen years of my practice of orthodontia, I have watched for cases in which I could be certain that I could extract teeth as Dr. Case recommends and be sure of getting a more desirable result than I could by retaining all of them; and I have never yet found one. Perhaps I could not distinguish them, but since that time I never have extracted teeth in such cases.

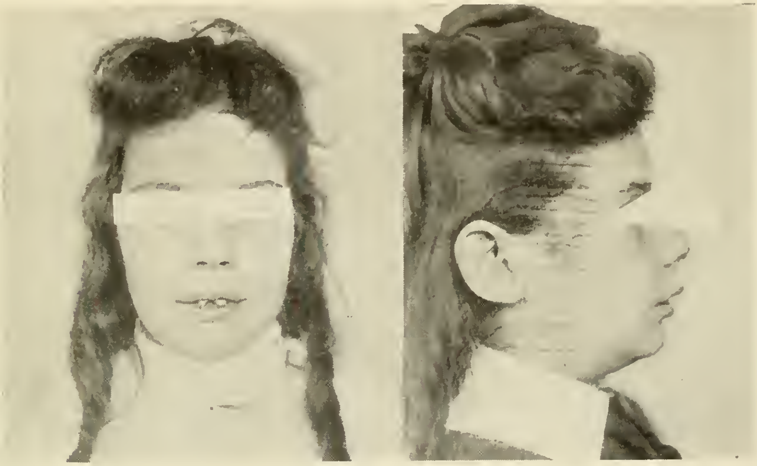


Fig. 3

I have taken a great many face masks, but have long ago abandoned it because I do not believe they tell the whole story. They do not give the same correct view of the form of the head and expression of the face that is obtained by photographs.

Hereditary Cases.

As to the matter of inheritance, Dr. Case is positive in his statements that only those cases that are inherited does he treat in that way, and he is very positive that he can tell an inherited case.

So far as treatment is concerned, it has been my experience that there has been no more difficulty in treating cases in which the father and mother had the same deformity than is in a case where they did not; and it is rare to see this deformity in both.

Dr. Casto. Do you call that case inherited or not?

Dr. Hawley. At that time, I could not tell, and I cannot now. I will say that in the opinion of scientists an abnormality through one generation cannot be inherited. I have looked upon it in this way, that in case we did find the same abnormality, the same distoclusion in the child (as in father and mother), the environment was the same and the conditions were the same that produced the malocclusion, but not that it was inherited, nor that that fact was any obstacle to its treatment. It seems to me, if we consider the question of inheritance, we must also consider the fact that, as Dr. Gregory says, for twenty millions of years mammals have inherited normal occlusion; and would there not be more likely a tendency to maintain the normal occlusion than abnormal occlusion? It seems to me that is a far stronger argument.

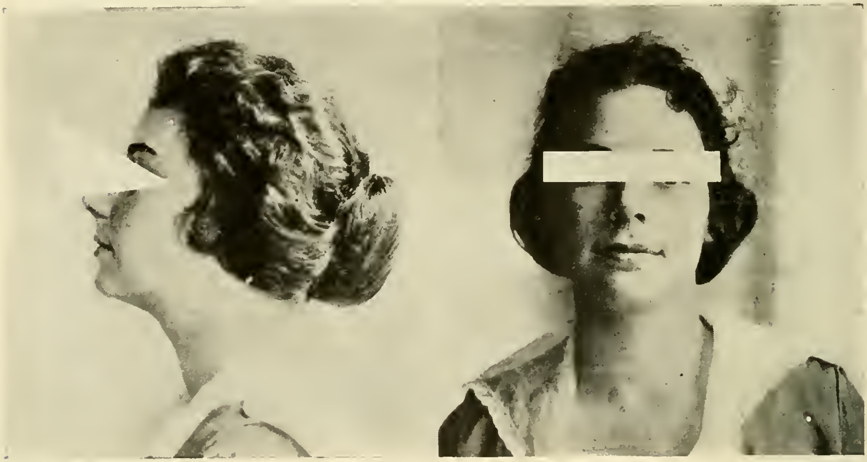


Fig. 4

Coming down to a later time, we will say for ten thousand years, the normal human being has had a normal mesio-distal relation; and is it not just as reasonable that inheritance would tend strongly in that direction, instead of, as claimed, that in one generation from father to the child, you could have an abnormality handed down that will persist?

Distal Occlusion.

Dr. Case states that we should better come to the conclusion that distal occlusion is for all practical purposes as good as normal occlusion. Is it? In a normal occlusion the strong lingual cusp of the upper molar works in the middle of the sulcus of the lower first molar, as a pestle in a mortar. There is great strength of mastication in this normal occlusion; in distal occlusion the strongest cusp works between the two teeth. If there is some reason why, through all these thousands of years, normal occlusion has been inherited, is it not because normal occlusion is more efficient for mastication?

In the cases where I have had difficulty in maintaining the mesio-distal relation, it has been my tendency to seek the cause, and many times I have found it and it can be readily pointed out.

Causes of Failure in Retention.

I have one case that I brought with me that I can use for illustration. I brought it to show primarily that it is a partial failure after three years retention after appliances were all removed, and to show the reason why.

This child was about twelve years of age, was treated for about two years and a half, retention was used for two years, and the mesio-distal relation seemed to be well established; then the girl went away. She left town for a boarding school and was gone for three or four years. She is now twenty years of age, and came back a few weeks ago with this condition (Fig. 2). You see the mesio-distal relation is not being perfectly retained. Neither the father nor the mother of this girl has distocclusion, so it could not be inherited.

When I took models and made a careful examination, I found that the cuspids and the first bicuspids had contracted about the sixteenth of an inch, so that it was impossible for the lower jaw to close forward in proper position. I put on a lingual appliance with little finger springs, and in about three weeks opened the arch in this region, and without intermaxillaries at all, the jaw moved back to a normal mesio-distal relation. Upon taking radiographs of the upper third molars, I found them both impacted. It seems to me that possibly this is a cause for this failure, and I am not discouraged in this case at all, as I fully believe that with a removable retention and with the removal of the impacted molars, I will be able to retain the case permanently.

I show this case because I believe it illustrates the reason why many Class II cases tend to return. Obviously as long as the arches are kept in the normal relative sizes the patient cannot bite in distal position. The teeth will not occlude in that position; but a fixed retainer is used and generally it is removed too soon. The upper arch commences to contract and the lower teeth seek a distal position to find a more comfortable occlusion.

It is largely a question of interference. A slight interference will throw a case into distal-occlusion. I have had a thick ridged band on a lateral incisor or the tilting of a second molar throw a case into distal relation. If we carefully look for the cause in the cases that have relapsed, we will find some interfering cusp or other cause that has been overlooked.

This (Fig. 3) is of the face before treatment, and this

(Fig. 4) after. Dr. Case recommends extracting in "all inherited and even long acquired disto-mesial malinterdigitations of the masticating cusps." This was a well established distal relation. It seems to me that the extraction of the upper bicuspids would be likely to carry back the upper lip, and even with the retention of all teeth there should not be attempted any recession of the upper lip. While possibly it takes longer, and I will admit many of these cases take longer and more persistent treatment, yet it seems to me worth while, and if it were my daughter I would take years and years rather than risk the extraction of the teeth.

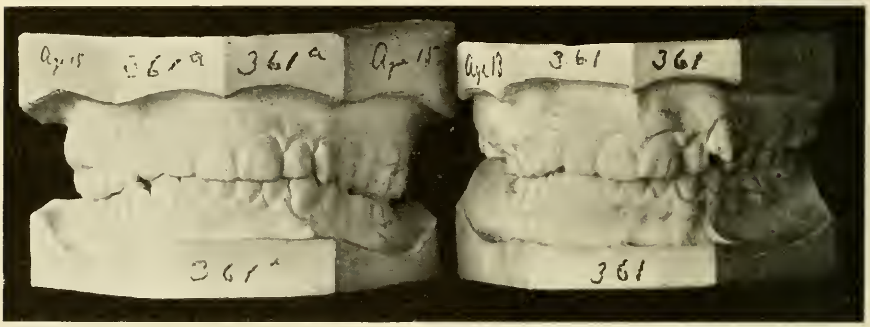


Fig. 5

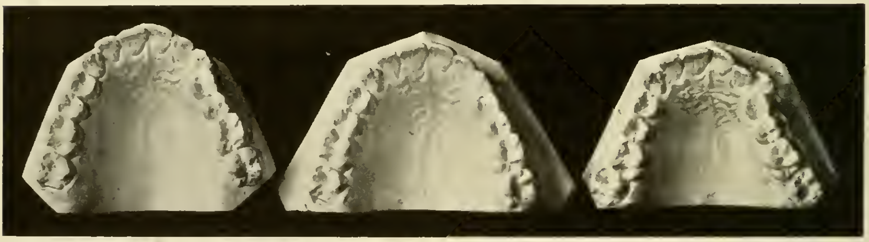


Fig. 6

As for Dr. Case's proposition to open spaces for a bridge tooth, in the light of the revelations concerning the life and stability of anchor teeth in bridgework, even though they be vital teeth, the evidence produced in examination of bridgework shows that in a short time the anchor teeth will be crippled by changes in the supporting tissues or devitalized.

Here is another set of models of a case I treated a number of years ago (Fig. 5). Unfortunately, I have left the slide at home showing the mesio-distal relation, but this was a distoclusion case. This case was treated, for I do not remember exactly how long, maybe two years, and then was retained with fixed retainers, and all the retainers had been off for over three years. The patient came back two or three weeks ago, and this is what happened: The case on the right (Fig. 6) shows the upper arches in their original position. The middle one is in the relation in which I placed it, or as it was when I took off the retention, and the one to the extreme left shows the condition in which it is now.

It is a type of failure to which I have previously called attention—not the relapse of the mesio-distal relation, because the mesio-distal relation of this has remained perfect. Even in the present state of this case, I do not feel that treatment is a failure by any means.

To go further, why is it a failure? In the first place, I provided a fixed retainer which was removed at a definite time, and neither I, nor any one else, could tell whether that was long enough. Then, when I radiographed the third molars in this case, I found them all impacted. It is my impression that it is the crowding of the eruption of these third molars that has been responsible for a partial relapse in retention, and I fully believe that with the removal of the third molars and with a little further treatment and a removable retention this case will be completely successful.

I am not going to quarrel with any one, least of all with Dr. Case, nor say he has not the right view in some cases, the mature cases, which have reached the age of fifteen or sixteen or more. He may find it expedient and better for him to extract bicuspids, maintaining the procedure he has described, and yet some of the cases in my own experience that have responded most readily to the correction of the mesiodistal relation have been some of these older cases. I have been astonished at this, but it is true. When the arches are widened and placed in their normal harmonious relation, there has been no great difficulty in maintaining and correcting the mesio-distal relation.

Where I quarrel with him decidedly is in his broad assumption that no one is succeeding in retaining Class II and Class III cases.

The Case Retainers.

There is another part of the paper that is important. Dr. Case speaks of a form of retention which he has used for twenty-five years with uniform success, and he wonders why we have not all taken it up. I am not going to speak for anybody else; I am going to be frank and tell him why I have not taken it up. Dr. Case intimates in his paper that the reason this has not been universally taken up is because it is difficult of construction. I do not think that is true for one moment. I do not find that this is particularly difficult of construction, and we do dozens of things in orthodontia that are far more difficult than the construction of this retainer. I have seen several of these that Dr. Case has placed in the mouths of patients, and they are certainly made beautifully, and his technic is fine. I have made probably half a dozen of these retainers,

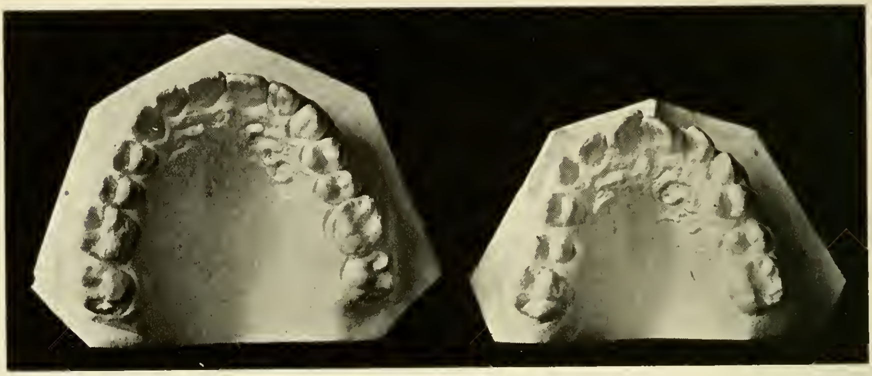


Fig. 7

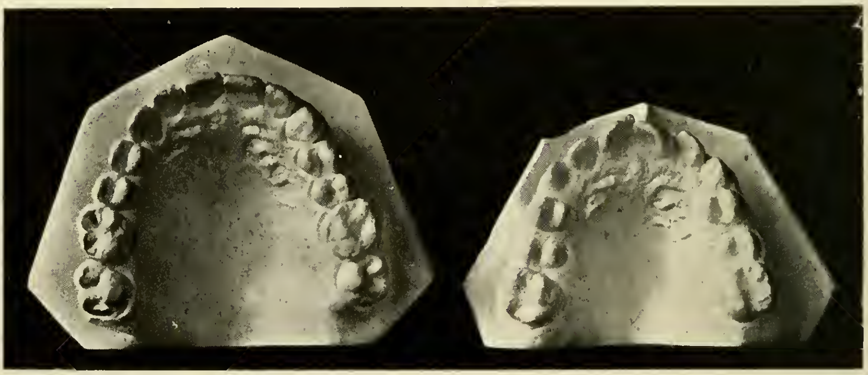


Fig. 8

and I thought I succeeded pretty well. I do not say they were as good as those of Dr. Case, but they were fairly good.

Now, the reason I do not like them is this: They will get out of order; the cement will wash out between the lingual surface of the retainers and the teeth, and this makes an element of danger. I have never had decay in these cases occur between the teeth, but I have heard of a great deal of trouble with decay of the teeth occurring where these little points pass in between the teeth. But there are other greater objections to this retainer in my mind. It holds the teeth too rigidly. I do not believe that absolutely rigid retention of the teeth is the best thing for them. They must have more individual movement.

The other objection I have to the retainer is that it must be worn (with bands on the teeth) for a definite length of time. Dr. Case says generally two years, and then all removed and trust to luck for the results. No man can tell just the time when you can remove any fixed retainer, and I do not believe a great many of the cases will stay after being retained with a rigid retainer such as this for two or even three years. For that reason, in my effort to correct some of these details of retention, I have used another type of retention with which you are all familiar. With the removable retainer, you can also hold the bodily movement of the six anterior teeth and, in fact, produce bodily movement with it; and is it not safer? There is no definite time when you take it off and say: "Well, we will trust to luck for the result." While the retainer of Dr. Case is perfectly satisfactory to him, it seems to me to have very vital objections.

Retention of Rotated Teeth.

The question of whether this removable retainer is efficient depends largely on this one question: Can you retain a rotated tooth with it?

Here is a case (Fig. 7) that was treated, in which there were rotated anterior teeth. There never was any retention upon this case except a removable retainer, and that has been worn for three years, and I have seen the patient four times in that time. Would I have been safe if there had been cemented bands on the teeth in that time? Directions were given that I should see the patient oftener, but like many other patients, she did not come. There are no decayed teeth, and the rotation was maintained.

Here is another case (Fig. 8) that never had a fixed retainer, but a removable retainer, and has been retained for a year and a half. I have seen this case more frequently. There was a period of six months when I did not see the case. It seems to me, that if rotation can be retained and bodily movement can be retained with a removable retainer, without the danger of decay of the teeth from a dozen bands, and without the danger of decay between the teeth, it is a much better procedure than to use such a complicated construction as the six-band retainer.

Dr. Case, in closing his paper, states that this treatment which he has advocated here is only used in his practice in a small percentage of cases, yet, he pleads for a thorough revision of the methods of practice of other orthodontists because it has been stated and acknowledged that in cases *not confined to the small residue which he has treated,* absolutely ideal occlusion is not established. I want to say that I believe, so far as I know from my communications with orthodontists, the majority of their cases of treatment of disto-occlusions or mesio-occlusions have been successful without the extraction of teeth.

Many cases give trouble; there is no question about that, but we are finding out more and more the reasons why. Many things can be improved and I believe will be improved, but I am sure that I myself, and I do believe that the majority of orthodontists, have no tendency to turn in the direction of the method Dr. Case has described.

Dr. J. Lowe Young, New York City.

I think Dr. Case is familiar enough with the American Society of Orthodontists to appreciate that when he comes before us to present a subject for discussion that the discussion is to be frank and open and that there will be nothing personal in it; the object being the promotion of the science of orthodontia.

In my judgment, Dr. Case has been very consistent in what he has presented here today. He has outlined where he would open up spaces and put in extra teeth in certain few cases. He has, however, made a few statements which I think are not fair, and one statement in particular that I object to is that lower teeth in distocclusion in relation to the upper are as efficient as when they are in normal occlusion. That this is not a fact can be easily proven by careful examinations from the lingual view of casts of such cases.

I would like to suggest to the essayist that when he prepares another paper using lantern slides showing plaster casts that he have pictures so made as to be readable. Those he has used for years have been so small it has been absolutely impossible for anyone to accurately follow his description of the cases in point. We have had to take the whole thing on faith.

I would not have the temerity, from what the essayist has shown on the screen today, to say he was wrong in many of these extractions because of the impossibiliity of judging the cases from such small pictures as referred to above. I believe, however, from the bottom of my heart, that in advocating the extraction of teeth he has done more harm to the cause of orthodontia than he has done good.

I do not mean by this that he has practiced wholesale extractions and that he has done particular harm by that means, but he must realize that the dental profession for generations have been keen to remove teeth with the false idea that this simplifies treatment. I feel sure he realizes when he has extracted teeth he has not facilitated treatment. He has done it with an entirely different thought. He has done it because he has felt that in certain peculiar cases he would get a better facial or final result than if all the teeth remained in the mouth. It has not been a question of expediency but the dental profession does not get this phase of it. They say "Dr. Case extracts teeth" and therefore it encourages them to extract teeth and they do it in countless cases where I am perfectly satisfied the essayist would never think of resorting to such a method of procedure.

The case shown by Dr. Hawley I am sure substantiates this argument. It is very doubtful if Dr. Case would have advised extraction in this case, but Dr. Hawley got the wrong viewpoint.

Two weeks ago a patient was referred to me by a dentist with a very simple Class 1 malocclusion. The space for the upper right cuspid was almost closed, due to premature loss of the deciduous teeth. The dentist advised that a tooth be removed; stating that the removal of the first premolar, which had just erupted, would simplify treatment. This I absolutely refused to do for a child ten years of age, so they decided to take the other fellow's advice and have the tooth removed, with the result that this child will limp through life with a mutilated set of teeth due to the dentist looking at things from the wrong angle. Now I know Dr. Case would not think of extracting in such a case.

Dr. Thomas L. Grisamore, Chicago. I hesitate to take the time of the society because I know you are behind with the program. However, I want to compliment the essayist upon this most excellent paper. It gives me great pleasure to inform this body of orthodontists that what little success I have achieved in the practice of orthodontia has been very largely due to the teaching and influence of Dr. Case.

When Dr. Case presents a subject to the dental profession I know it is based on his practical experience, and the theories presented have been thoroughly tested in his own private practice, and we can rest assured that in this way he obtains the best possible results. I have heard him teach for years, and he does not only teach what he believes and what he practices in his own office, but he teaches the things that other men practice and teach. Furthermore, he does not hesitate to adopt other men's methods in his private practice, if by so doing there is a possibility of serving his patients to a better advantage.

About thirteen years ago, when I first became associated with Dr. Case in teaching, he said to me: "You will live to see the time, but I never will, when the orthodontists in this country will advocate and practice the bodily movement of teeth and the occasional extraction of a tooth during orthodontic treatment." Dr. Case himself has not only lived to see the orthodontists practice bodily movement of the teeth, but to see a great many efforts put forth trying to develop some simple appliance to produce this movement. He has also seen practiced and heard papers read before this organization advising the extraction of teeth for orthodontic purposes in certain classes of malocclusion.

Regarding what Dr. Hawley has said, I am afraid there are orthodontists in this country who believe that Dr. Case removes teeth, or inserts artificial teeth in every case in which there is a mesio-distal malocclusion. I firmly believe that if any of you would go to his office and look over his cases for the past ten years you would find the percentage of cases in which he has extracted or inserted artificial teeth would not be greater than that of the majority of orthodontists who have been practicing for twenty years. He does not extract nor does he insert artificial teeth in all these cases. He does not extract any more teeth than any other orthodontist, but he talks more about it and it appears as though he does. Dr. Case does not extract teeth except to a limited extent, and if you will read his papers carefully you will find he says so.

The attitude of the dental profession, as well as the orthodontists all over the world toward Dr. Case, is sufficient answer to Dr. Young's remark regarding the influence of Dr. Case's lifework. He teaches students that in a very large percentage of cases it is not necessary to extract teeth; he teaches them that in practically all cases they should put on appliances and try to produce normal occlusion before they resort to extraction. He teaches them to try to bring about normal occlusion, and if the dento-facial area is out of harmony with the immovable features of the face, then it is time to extract. You will also find that in cases where he has taken out teeth there was a decided protrusion of the entire denture and where he has inserted teeth there was a decided retrusion of the entire denture, and in practically all of these cases the patients were older individuals, most of them between eighteen and thirty years of age.

He has practiced orthodontia much longer and treated many more cases of mature years than most of us. I am sure you would be surprised if you should go through his records to find the number of cases he has treated between twenty and thirty years of age. You will find these are the cases in which most of his extraction or insertion of artificial teeth have been done. This method is seldom resorted to in younger individuals.

Dr. Case (closing). It seems to me much of the discussion has been quite foreign to the paper. I am indebted to Dr. Casto for giving the general principles pertaining to retention, as I felt that I could give no more than a cursory review of principles which pertain strictly to my subject.

My paper pertained to a very small number of cases that we find in practice, i. e., extensive protrusion and extensive retrusion of the upper and lower dentures in classes second and third, which arise from heredity.

I should like to have the time and ability to speak extemporaneously in regard to the question of the laws of heredity, and how I happen to know that this or that case is an inherited case, but there is not time, and in fact it is something that requires a broad understanding of some of the principal laws of biology.

There is one point I want to mention in regard to Dr. Hawley's discussion. When a man illustrates a single case that he has corrected or attempted to correct himself, and it has proven a failure, and sets that case up as an example and argument against an extensive and successful practice of any man whose methods differ from his own, it seems to me very absurd, with all due respect to my dear friend, Dr. Hawley.

I can see how after extraction of the bicuspids, for instance, followed by a lingual inclination movement of the front teeth, that anyone would produce exactly the same result he has shown. That is what I often do in the first retrusive movements of the six front teeth. I have case after case showing the difference between the proper bodily retrusive movements of the roots of these same teeth and their inclination retrusive movements. He has not moved the roots, and consequently he has left a protrusive condition at the upper apical area.

(Dr. Case was asked to continue his discussion in writing, to be published with the proceedings.)

Dr. Case's Further Remarks in Writing.

"Since a careful reading of the stenographic report of the discussion of my paper, I am more than ever convinced that the real claims of my paper were not specifically discussed, notwithstanding the length of the discussion, which wandered into many by-paths pertaining to the general practice of orthodontia, many of which I did not even touch; and in some particulars the discussants misquoted and misconstrued the reading of the paper itself, all with the view apparently to destroy the force of my evidence, which they seemed to fear would do harm to their established principles of practice.

Now, I want it to be understood that I have no quarrel with these very good friends of mine, who have always treated me with the greatest possible consideration, but I can now understand what Dr. Hawley meant when he has said to me on several occasions that the members of this society are very outspoken in the discussion of all papers; and I am pleased to find that this spirit has been so freely exercised on this occasion, because it gives me a chance quite as freely to express my thoughts in the same frank and friendly spirit in defence of the claims of the paper and much that was outside of the paper itself.

Angle's Views.

While I have always fully appreciated the wonders which the American Society of Orthodontists have accomplished in advancing the practice of orthodontia and its general employment, I have always believed, and now more especially after this discussion, that there is one unfortunate drawback which in my humble estimation seems to prevade this society and retard its development toward true scientific advancement, which is: that a number of its most influential members are so obsessed with the Angle radical teaching in regard to causes, extraction, and the normal occlusion formula, that they cannot see that there is anything true outside of it, and I am especially surprised to find that they still swallow whole Angle's fantastic teaching that all children when born are destined through inheritance to possess normal occlusions, which would always obtain were it not for certain local causes, etc., etc. All of this, I now emphatically assert, is contrary to the vital principles of biology which is taught in our schools, and regarded as one of the requirements of education. Judging from the arguments expressed by the discussants who tackled this part of the subject, it would seem that they do not think it of sufficient importance even to superficially inform themselves in regard to scientific principles and clinical evidence, which abundantly disproves the radical and absolutely silly assumptions.

The influence of these leaders is so strong and so arbitrarily kept before this society that its members hesitate to express opinions which they are plainly given to understand are contrary to the so-called basic principles of advanced orthodontia, but which they actually believe and practice; and moreover, what they have learned by experience they must practice if they arrive at results which they are beginning to appreciate and understand can only be fully accomplished in a rational practice of orthodontia. Even my friend, J. Lowe Young, who told me years ago that he believed that heredity is one of the principal causes of malocclusion, did not consider it politic—or something—to say one word in defense of heredity in his attack upon my advocacy of rational extraction, which he must know is founded almost solely upon heredity as the cause of conditions which demand extraction.

This arbitrary imperialism of the leaders was shown in Dr. Hawley's remarks when he so scathingly condemns a man or men who have the courage of their convictions to say, "they fear that orthodontia is more or less of a failure," after finding "that it is impossible to permanently retain a large proportion of their most important cases"—probably the very kind of cases to which my paper referred, and which they had corrected by an extensive disto-mesial movement of the entire dentures to a normal occlusion. And he continued to ring changes upon that very natural "failure" quotation of mine until he had twisted it into the assertion that I stated in my paper that "the modern practice of orthodontia as conducted by most men in the profession is a failure," and "the implication is that the whole practice of orthodontia, except along the lines he (Dr. Case) indicated, is a failure." That certainly is a very liberal, friendly garbling of my paper, which practically, in itself, referred to only three distinctive characters of malocclusion. I may be wrong, but it seemed to me this endeavor to place me in the wrong light before the jury at the outset of his discussion was not so much because of my quotation, as it was to vitiate the real claims of my paper in daring to propose a remedy before this society for the obviation of these failures which did not regard a normal occlusion of the teeth as so essential to the patient as the correction of facial deformities and permanency of retention, though it left the patient with an occlusion which was sufficient for all the necessary purposes of mastication.

The particular characters of malocclusion to which my paper was specifically confined were inherited pronounced upper protrusions and lower retrusions of class II, and upper retrusions of class III. In the correction of all of these characters whenever in my early practice I attempted to shift the entire dentures to a normal occlusion in connection with bodily linguo-labial movements of the front teeth, it was impossible for me to permanently retain them, and because of this and its very great importance, I also was fast coming to the conclusion, in those days, that orthodontia was so much of a failure I would have gone back to the general practice of dentistry had I not discovered the remedy. And now when I place it before this society in an honest endeavor to help others, who like myself (keep it as sly as you choose), are fast coming to the same conclusion, I find that the consensus of opinion among these few leading members, at least, is that all my principles of practice are wrong in regard to causes, diagnosis, treatment and retention. And I cannot help but believe that this is because the remedy I proposed for these special failures is contrary to the arbitrary teachings of Angleism. (Please to understand that I use the term Angleism in an adjective sense, and with no desire to cast opprobrium upon Dr. Angle himself.)

All this part of Dr. Hawley's discussion was of course presented in a very friendly manner, and aroused no feeling in me except to give me a few moments of good natured amusement; especially when my friend Young asserted that I have done more harm to the cause of orthodontia by my advocacy of rational extraction than I have ever done good. Well, perhaps there are times when the truth should not be told. But not when it pertains to the alleviation of wrongs to many people, among which may be mentioned the unfortunate practice of stamping for life upon the physiognomies of our confiding patients, noticeable facial imperfections and deformities which lie within the province of orthodontia to permanently correct.

The incident which he portrays of the dentist who wrongfully advocated extraction is not an uncommon one, and with results at times that are exceedingly harmful. But is that legitimate evidence that under all circumstances in orthodontia no teeth should ever be extracted? If so, then the thousands of disasters which are constantly arising from ignorance or the inexcusable acts of fools should be regarded as evidence that we should not desist from the employment of many of the greatest benefits of life.

When Extraction is Advocated by Dr. Case.

Among the three characters of malocclusion to which my paper specifically referred, there was only one for which I advocated extraction of teeth. This referred to inherited upper protrusion, with the lower denture in normal dento-facial relations, and with the lower buccal teeth in full distal malinterdigitation. In following the theme of my paper I explained that one of the main reasons why I extract teeth in these cases is to avoid an extensive disto-mesial movement of the entire dentures required by a normal occlusion, and because I have found after many years of experience that such extensive movements of the entire dentures in inherited cases cannot be permanently retained. Not but that there are other characters of pronounced protrusions for which I extract teeth, but this was the only character which I specifically mentioned that demanded extraction; and consequently, it was the only one that should have been discussed in relation to extraction. But what was the result? Before we got through it seemed that almost the entire discussion pertained to the general question of extraction, even to extraction for impactions of third molars. And through it all no one intelligently stated the particular malocclusion for which I advocated extraction.

Yes, Dr. Hawley it seems had a case of this kind in his early practice which, from the illustrations he threw upon the screen, appeared to be a bodily upper protrusion, which he presented to show the results that might be expected in following my method of treatment in these cases. If he had had an intelligent understanding of my method of treatment, which was fully published in all the leading dental journals at that time, he would have known that his case demanded a bodily retrusive movement of the upper front teeth after extracting the first bicuspids, and not the application of a single traction arch bow, which of course tipped the crowns back and the roots forward.

The Case Retainers.

I am wondering if he did not make about as much of a mechanical *faux pas* in the construction of that "half-dozen" retaining appliances which he says he made according to my methods, "that require no special skill." I do not in the least doubt they were failures in his hands, and I certainly wish him every success in the employment of that most primitive of all retainers, rubber plates. Though, judging from the many years of my employment of rubber plate retainers in my early practice, orthodontia certainly would be a failure to me if I had to rely upon that method of retention. But I have this to say in its favor: It certainly is much safer than those spurs and bars soldered to cemented bands resting on enamel surfaces, that have been employed so extensively.

I wonder if it is possible that the kind of talk which Dr. Hawley gave in regard to my retaining system—of which he has practically no experience nor intimate knowledge—could convince an appreciable number of intelligent members of this society who are acquainted with me and my work, that I would continue to employ this six-band retainer with auxiliary attachments for every case I have regulated for twenty-five years if it did not fulfill every requirement that can reasonably be expected of artificial retention? And I believe it will do the same in the hands of every orthodontist who is capable and willing to put into its construction that exacting skill which it demands and who will see that it is properly taken care of during the time it is worn.

One would think from Dr. Hawley's remarks that these retainers are left on the teeth without removal, and possibly without being seen during the entire time they are worn, and then at a stated period of two years they are removed without further thought, and as he says, "trusting to luck" as to whether or not the teeth retain their positions. All of this shows that he knows nothing about them from a practical sense. Whereas, the facts are that every patient is instructed how to keep them perfectly clean, especially above the interproximal clips, and then he is warned of the danger of not submitting them to an expert examination as often as once in two months to see that the forces of occlusion, etc., have not started the cement attachments, or that the cement is not being washed out, as it will at times even around the best of cast fillings. If this happens the appliance must be immediately removed. This is easily accomplished with pliers especially constructed for that purpose. The appliance and teeth are cleaned and all imperfections corrected before recementing.

It is true that patients at times through necessity or carelessness do not regard these admonitions, and because of that disasters arise. But is that not true at times in regard to the care of the teeth in general? Occasionally, but rarely, it will be found that this appliance, which is necessarily frail and artistically delicate in construction, does not prevent the strong inherited reactive forces of the original irregularity from moving the teeth in phalanx, though perfectly within the grasp of the cemented bands, and with the appliance reinforced lingually with a No. 28 gauge clasp-metal plate. In one case recently these same forces caused an original malturned central incisor to break loose from its cement attachments and start to go back, though when attached it was perfectly within the grasp of its cemented band, three-quarters of the way around the tooth. It simply required a little firmer attachment. Of course such an event could not possibly arise in Dr. Hawley's hands with a removable rubber plate resting loosely against the lingual and interproximal surfaces of this tooth. But just wait and see what will become of this method of retention in a few years when it has had time to be actually tried out.

I wish to say further that the six-band retainers usually remain on the teeth six months and longer without the necessity of removing them. In one case—that of my own daughter—the retainer remained without a single removal for two years, probably because of its special care, and since that time her teeth have never changed nor shown one ill effect from the retention. Dr. Harper, a noted dentist of Chicago, who cares for them, will vouch for this.

Dr. Hawley is right when he says that no one can tell when to stop artificial retention, except by trial. I have known of a number of cases whose malocclusions arose from heredity, which have been regulated with a view to permanency of retention by rational methods, and which have started to go back after heavy use, perfectly retained in position for two years, but after being corrected and the same appliance or a new one is worn for another six months or a year they never again changed. In these same cases had the entire dentures been shifted to a normal occlusion, nothing on earth could have produced permanency of retention. On the other hand, a large majority of cases in orthodontia arise from local causes and are therefore favorable for retention. Even pronounced protrusions and retrusions arise occasionally from local causes. Consequently, in all of these cases or those which may have arisen in this way, among youthful patients especially, the retaining appliance, after it is worn six months or a year, is commonly left off for a few weeks or months' trial, and if the teeth retain their positions it is not replaced.

In one case (that of the young woman who will type this manuscript) in which an upper protrusion was corrected after extracting a single bicuspid at the age of twenty years, the retaining appliance was worn less than six months. Since that time I have frequently shown her teeth to my patients as a type of a perfect occlusion.

Rigid Retention.

Among the many criticisms of this system of retention that have been made, always by men who have had no correct experience with it, the silliest is that it retains the teeth "too rigidly in one position," and therefore, it is against physiologic principles and should not be employed. They do not always state exactly why, but leave it to the fertile imaginations of others to juggle with. And so Dr. Hawley tells us that he "does not believe that many cases will stay after being retained with a rigid retainer such as this for two years," etc., etc.

Physiologic Demands in Root Movement.

Now let us briefly come right down to the truth of this question of the mechanico-physiologic demands of masticating root movements which has been quite extensively aired of late in papers and discussions upon the question of fixed and removable bridge dentures and upon which I have expressed a somewhat lengthy opinion from a mechanical viewpoint, and incidentally from physiologic and pathologic standpoints. This was read in connection with Dr. H. J. Goslee's paper before the Chicago Dental Society and published in the September, 1919, *Journal of the National Dental Association.* In the biologic evolution of dentures, one of the functions of the pericemental membranes is to act as cushions in the sockets, to guard against injury or the devitalization of teeth, occasioned from sudden blows in the forces of mastication, etc. Consequently, because of this cushion quality, the teeth throughout untold generations have been caused to move slightly in their sockets under the forces of mastication, and therefore, this movement of the roots has in turn become a co-ordinating necessity to the health and vitality of the surrounding membranes.

Effects of Fixed Bridges.

It is claimed that many extensive fixed bridge dentures whose pier attachments are sufficiently strong to prevent them from breaking loose, hold the roots so rigidly in one position that their functional movements in mastication are prevented, and when this goes on for years the functional activities of the pericemental membranes are impaired, followed with disease, death, etc. This no doubt is a true history of many extensive bridges when worn long enough, though it is not so true of small two-pier bridges. That is my main objection to fixed bridge dentures which need not be discussed here from a mechanical standpoint.

Conditions After Orthodontic Tooth Movement.

Now consider for a moment the condition of the alveolar and membranous surroundings of the roots of teeth during and immediately after their orthodontic movements, often with their sockets passing through a profound state of physiologic repair and bone-growth, and compare that with the normal surroundings of vital and pulpless teeth that are employed for bridge dentures, and then ask yourself if the two conditions come under the same category of argument. Remember also, that nature's first act before the repair and union of fractures can take place is to build a firm splint or bony callous to hold the parts immovably in relation to each other. Is it not therefore more in accord with physiologic demands to hold the roots of the teeth comparatively still during the processes of permanent repair of their sockets in the new positions, than to employ a removable retainer which every time it goes in and out may produce ten times more movement to the roots of the loosened teeth than nature performs in the physiologic movements of mastication? Besides this, the *crux critiorium* of this whole attack upon the six-band retainer is that it permits the slight physiologic movements of mastication that are necessary for normal activities, because of the yielding quality of its delicate construction.

Were it not for this the irresistible masticating movements of the teeth, which have been known to split the pier roots of bridge dentures in two, would soon completely destroy any retaining appliance that held them rigidly in one relative position. That is really the secret of their stability of attachment. No, you will have to hunt for something stronger than this before you can destroy by words alone the twenty-five years of established utility of this appliance, with which during the comparatively short time it is worn, if properly cared for, the teeth and gums are sure to remain in a perfectly healthy condition.

Extraction in Orthodontic Treatment.

Before leaving the subject of extraction, which was so extensively discussed, I wish to say that I have never advocated extraction as an aid to the correction of malocclusions, except in pronounced protrusive malpositions of entire dentures—the upper or the lower, or both dentures—in relation to the esthetic standard of dento-facial harmony for the individual.

There are certain things in regard to the correction of these cases without extraction that cannot be satisfactorily explained to any one who appreciates and values the possibility of a far greater correction of facially deformed outlines, and a far greater probability of permanency of retention with extraction, and who do not believe that the slight difference in mastication between normal occlusion and perfect malinterdigitating occlusions is a sufficient offset to these advantages.

Everyone who has given orthodontia any thought must see that upper dento-facial protrusions, in normal arch widths, with the lower denture and mandible in normal pose, cannot be corrected facially without extraction except by a retrusive movement of the entire upper denture the full width of a bicuspid. This is not to be thought of for many reasons, even if it were possible, and with difficulties greatly increased if the case demands a bodily lingual movement of the front teeth. On the other hand, if the treatment consists in a reciprocal disto-mesial movement of both dentures, with the intermaxillary force, you would only half correct the upper protrusion and abnormally protrude the lower. In other words, you would produce a partial bimaxillary protrusion. This has been freely pointed out in papers with illustrations from clinical results. But it requires no illustrations, as the statement of the fact is irrefragable. The same is true of lower protrusions with the upper normal. And in regard to the dento-facial correction of bimaxillary protrusions without extraction, one might as well attempt to lift himself with his bootstraps.

Heredity.

Now, a few words in regard to heredity, of which I should like to say much but the present length of my closing remarks will hardly permit. Since my interest and belief in the science of evolution, which began in the early 80s when I attempted the writing of a weekly column entitled "*Evolution*" in the leading daily paper of my home town, upon which I received many personal compliments, among which may be mentioned several encouraging letters from no less a man than the late John Fiske, author of *Cosmic Philosophy,* etc., I have always kept in rather close touch with the advancement of biology as an established science, particularly in its branch of anthropology entitled somatology and ethnology. I speak of these things at this time to show that while I claim to have no more intimate knowledge of these subjects than may be ordinarily found among educated people, whatever statements I may make are not founded upon guess-work, or a mere superficial understanding, which too often leads men to express opinions in public which they would never think of uttering were they more perfectly informed in regard to the work that has been going on in the world by original investigators and expounders of the truths of evolution and its branches.

I have long been impressed with the belief that one of the principal causes of malocclusion, and the one that has been the greatest stumbling block in diagnosis, treatment, and retention of our cases in orthodontia, is heredity. Not the kind of heredity necessarily that is popularly in mind when this subject is broached, i. e., direct from parent to offspring—for heredity has a number of other branches through whose mysterious channels malocclusions amounting to decided facial deformities are quite as liable to obtain; among which may be mentioned the union of disharmonious types, direct and atavistic, which has been abundantly proven through the remarkable results obtained in the breeding processes by artificial selection, or hybridizing. Furthermore, there can be no doubt in my humble estimation that in countries whose inhabitants are composed of a vast variety of mixed types, as in America, parental unions arise which fully respond to all the intricate demands of Mendel's law, which is one of the commonly demonstrated laws of heredity in cross-breeding.

If it is true—and as I believe every biologist will agree after giving a little thought to this branch of dentistry—that many of our most pronounced cases of malocclusion arise partly or wholly from heredity in some form, with its undoubted influence upon the advancing science of orthodontia, then we as practitioners and teachers of orthodontia should consider this subject worthy of the profoundest study. It is something which cannot be intelligibly explained in a few words, or even impressively referred to before men who have no foundation knowledge of the elementary principles and laws of biological evolution, any more than the higher branches of trigonometry can be taught to a class of students who only understand the elementary branches of mathematics.

With this in view, in the forthcoming edition of *Dental Orthopedia* I have devoted five chapters to the etiology of malocclusion, besides that which appears in diagnosis and practical treatment of classified irregularities, with the hope of giving to students at least a partial foundation for an intelligent understanding of the laws of heredity and natural variation which play important parts in the production of malocclusion.

The oft-repeated, and so far as I know, only argument that is used to show that malocclusions cannot arise from heredity is the statement that "abnormalities are not inheritable." This may be briefly answered. But when uninformed persons assert that all children are born with all the physical qualities and propensities of perfect anatomical harmony, which they would not deviate from in development were it not for diverting local causes; or the statement made by Dr. Hawley, that when a child is seen to possess the same deforming character of malocclusion that is seen in the parents, that there is no scientific reason for believing that it arose from heredity, but rather that both parent and child were subjected to the same environing causes, or the statement that the moon is a green cheese, if you please, because it looks like it, one cannot effectively combat such statements without presenting lengthy scientific information founded upon well established facts, which is not admissible here.

No one claims that "abnormalities," interpreted in a pathologic sense, producing at times deformities through preverted nutrition from disease generating bacteria, are inheritable, because every change in form from the primitive state which arises through heredity or natural variation must first be laid down during the metabolism of the fecundated germ cells, which is impossible with every form of microorganism. But what is important in this connection is, predispositions to these diseases are inheritable, which renders their development more possible, on the same principle that inherited immunity renders it less possible. All of this has nothing whatever to do with our subject, because the term "abnormalities," when rightly interpreted, means physical anomalies, disharmonies, etc. And while some of them like cleft-palate arise through interruptions in development during the early stages of utero-gestation, which may be caused by an inherited predisposition toward a lack of normal activity in the embryonic processes to normally unite, shown by several cleft-palate cases in one family or near relatives, and others from traumatic injuries even before birth, still this does not change the rule that all physical disharmonies, natural variations, and anomalies, such as irregular teeth, etc., are inheritable and pass through the same biologic processes as the normal. Would you say that a nose of deforming size in relation to the otherwise delicate features upon which it is placed has not arisen through some channel of heredity, and that it is produced from a local cause? Or that a prognathous mandible whose protruding position has carried the lower denture far in front of a normally posed upper, resulting in a pronounced malocclusion, has arisen solely from some local cause, when such conditions are the well established possibilities of cross-breeding? And so I might go on naming one proven fact after another that should thoroughly eradicate from the minds of sensible orthodontists that fantastic theory that all malocclusions arise from local causes.

I am often asked why it is that I consider it so important, from a practical standpoint, for orthodontists to believe that heredity and natural variation are among the main cause of dento-facial malocclusion. My answer is: First, because it is true—just as true as is the application of the laws of heredity everywhere. Second: because it opens a wide vista for correct diagnosis of many of the most important of our cases, and leads to a rational, effective, consistent, artistic and permanent system of correction. Third: it eradicates the cut and dried rules along mechanical and mathematical lines founded upon idealized "normal occlusion" as the basis of diagnosis and the one object to be attained at whatever cost.

June 24, 1920. Dr. Hawley has very kindly placed in my hands his revised discussion of my paper. I find it quite different in certain particulars from the stenographic report of his discussion made on the floor of the convention, to which my above closing of the discussion applie, but I feel that I can hardly be expected to cut out my answer to a number of his objections that were made before the society, and which was mailed to the publishers several weeks ago.

There are two misleading statements in his present discussion, however, which I did not notice in his original one, that I must answer, and preface with the statement that if there is anything calculated to roil an author it is to have an opponent of his principles misquote him and then follow it with an argument built upon this false premise. He says: "Dr. Case recommends extracting in 'all inherited and even long acquired disto-mesial malinterdigitations of the masticating cusps.'" This is a misstatement. He has gone far out of his way to find that particular combination of my words which he places in quotation marks in order apparently to make it appear that he has correctly quoted me throughout, and that I really recommend extraction in all occlusions of that kind. And he takes that quotation right out of the middle of a sentence which has no reference to extraction, but on the contrary, to opening spaces for the insertion of artificial retaining teeth in the treatment of pronounced retrusions of the lower denture in relation to a normally posed mandible and upper denture; a division of Class II of which I have for years stated everywhere in my teaching that extraction in these cases should be regarded as malpractice.

The whole of the sentence is as follows: "I was however coming to the conclusion which I hold today, that all inherited, and even long acquired disto-mesial malinterdigitations of the masticating cusps present conditions that should be disturbed with great caution, if at all, except to adjust the occlusion, and especially with no extensive distal movement of the buccal teeth, upper or lower, except in those cases in which the first permanent molars have drifted forward through the premature loss of deciduous teeth, or from other local causes."

Upon the strength of his incorrect statement that I recommend extraction in these cases, he goes on to illustrate cases in which he, Dr. Hawley, corrected them without extraction, just as I used to correct them by shifting the dentures to a normal occlusion, as shown in my Fig. 8, before I learned the danger of extensive disto-mesial movements of the buccal teeth.

The saddest thing to me in this regard is that he and others do not yet recognize the vast differences in character and demands of treatment in pronounced divisions of Class II, which are therefore treated in the main all alike under the head of "distal occlusions."

In another place he says: "Dr. Case is positive in his statements that only those cases that are inherited he treats in that way, and he is very positive that he can tell an inherited case." The above quotation which he himself made from my paper disproves this, and nowhere in my paper do I even intimate that I can always "tell an inherited case." The facts are that there are many cases which indicate heredity, and should be so regarded in the absence of the possibility of a local cause But that is a big question which cannot be taken up here.

Plastic Surgery of the Face.

By Joseph C. Beck, M.D., and Jacob Jesser, D.D.S., Chicago, Illinois
Read before the American Society of Orthodontists, Chicago, Ill., April 5-6-7, 1920.

The subject which I am to present to you was selected by your secretary, and I thought that in order to make it as interesting as possible, I would show some photographs and casts rather than lantern slides, dealing with plastic surgery. I have nothing to present to you in the way of war surgery, and I make this statement at the outset so that the gentlemen who are to discuss my remarks may know that these are not war cases.

We have learned much in regard to war surgery from the English surgeons, particularly Gillies, which we can now apply in civil practice. One of the two things I have learned from him is the use of osteoperiosteal grafts for the reconstruction of bony structures of the upper and lower jaw and nose; and the other is the use of long migrating tube flaps. I might simply illustrate this by saying that a big flap may be taken from the side of the chest and formed into a tube, sewed up upon itself with the epidermis externally and allowing it to become firm and self-sustaining. This is quite an advance in plastic surgery. These osteoperiosteal grafts, usually from the tibia, can be made as long as you wish to have them.

Cosmetic Plastic Surgery.

In civil practice we have two types of plastic surgery: (1) cosmetic type, such as hump nose, saddle nose, or a lateral deflection or twist; and (2) reconstruction type due to pathologic changes or injury. These are conditions which are mostly dealt with by men in our line of work (rhinologists) and require very little explanation.

These casts will give you an idea of the usual cosmetic deformities which require correction.

Such a deformity as shown in Fig. 1-A is best corrected by refracturing and plating. A large hump of the nose (Fig. 1-B) would be dealt with by removal of the hump through the interior of the nose. A saddle nose, such as shown in Fig. 1-C can be dealt with by the introduction of a tibial graft through the interior of the nose. One of the most difficult things to correct is a lateral defect of the nose, Fig. 1-D, where the cartilage is missing. In such a case transplantation of cartilage is used, although the result at best is not very good. A deformity such as that shown in Fig. 1-E, where you have marked destruction, is analogous probably to a war deformity and requires a great deal more work than the previously shown cases.

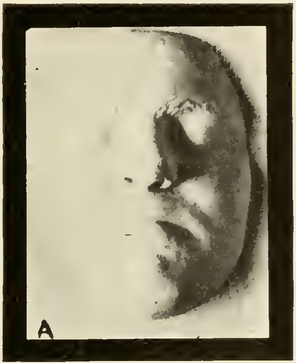


FIG. 1-A.

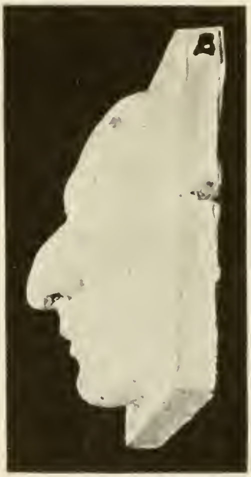


FIG. 1-B.

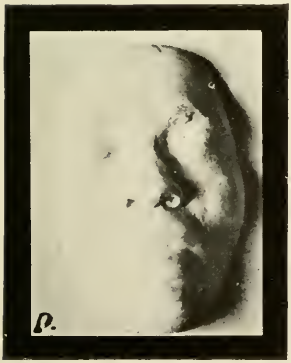


FIG. 1-C.

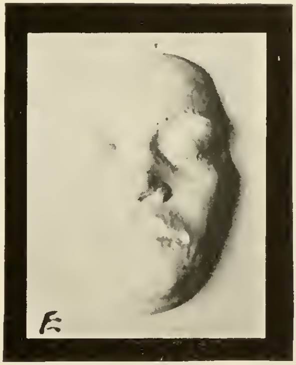


FIG. 1-D.

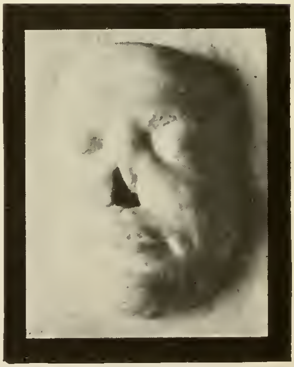


FIG. 1-E.

The cases I am going to show are extreme deformities of the face, particularly the nose (pathologic deformities), in which reconstruction has been attempted.

Case I.

(Fig. 2.) A young lady who has been the subject of maltreatment. This plate shows what her condition was originally (Fig. 2-A). We see many cases of imaginary deformities in people who seek some means of having the deformity corrected and they should be discouraged from such action.

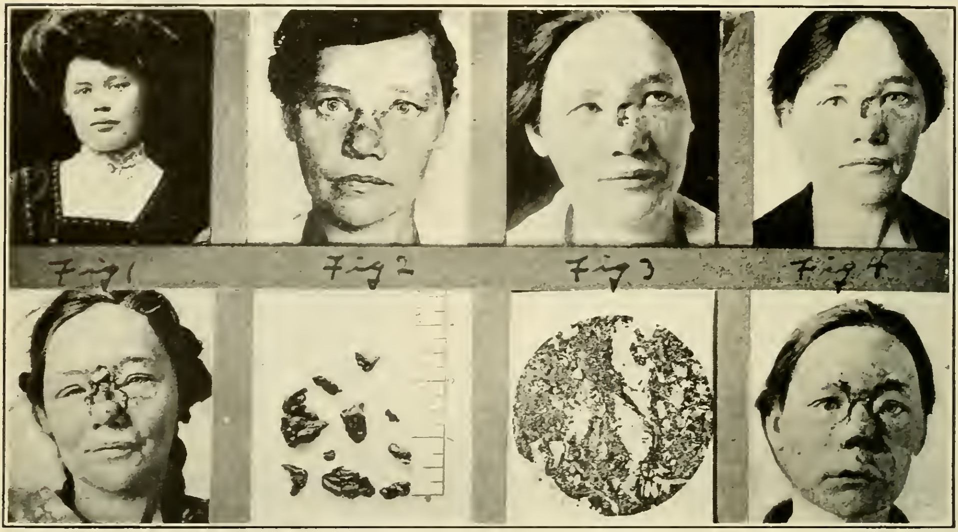
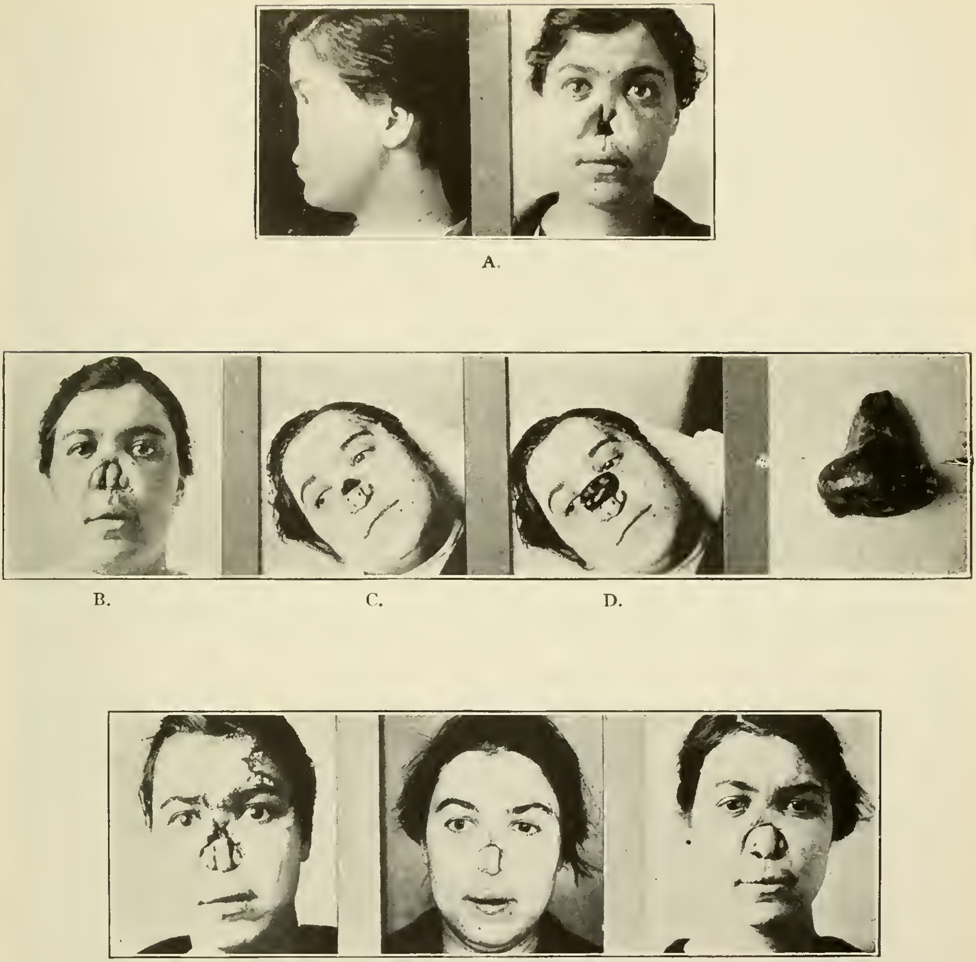


Fig. 2.

This girl applied to physicians to correct the deformity, which would seem to be a broad tip of the nose, and since no surgeon would do it for her, she consulted a so-called beauty specialist or charlatan, who injected a mass of paraffin. The injection of paraffin was followed by a growth of tissue around the paraffin, causing a tumor or paraffinoma. This tumor was not only deforming, but it discolored the skin and became very painful, so that it was necessary for me to remove that material in order to relieve her pain. These pictures show in series (Fig. 2) what was done. I excised the paraffinoma which reached into the orbit, the cheek and down over the lip. Subsequently I used twenty-five to fifty milligrams of radium over the connective tissue to stop this growth. The next step will be a plastic operation, where we shall take the skin either from the arm or some neighboring part of the face.


A.

B. C. D.

E.

FIG. 3.

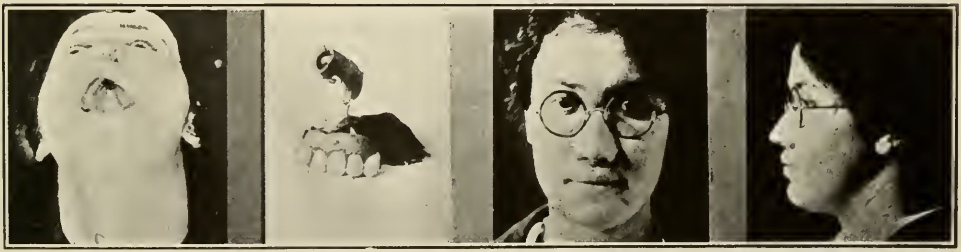
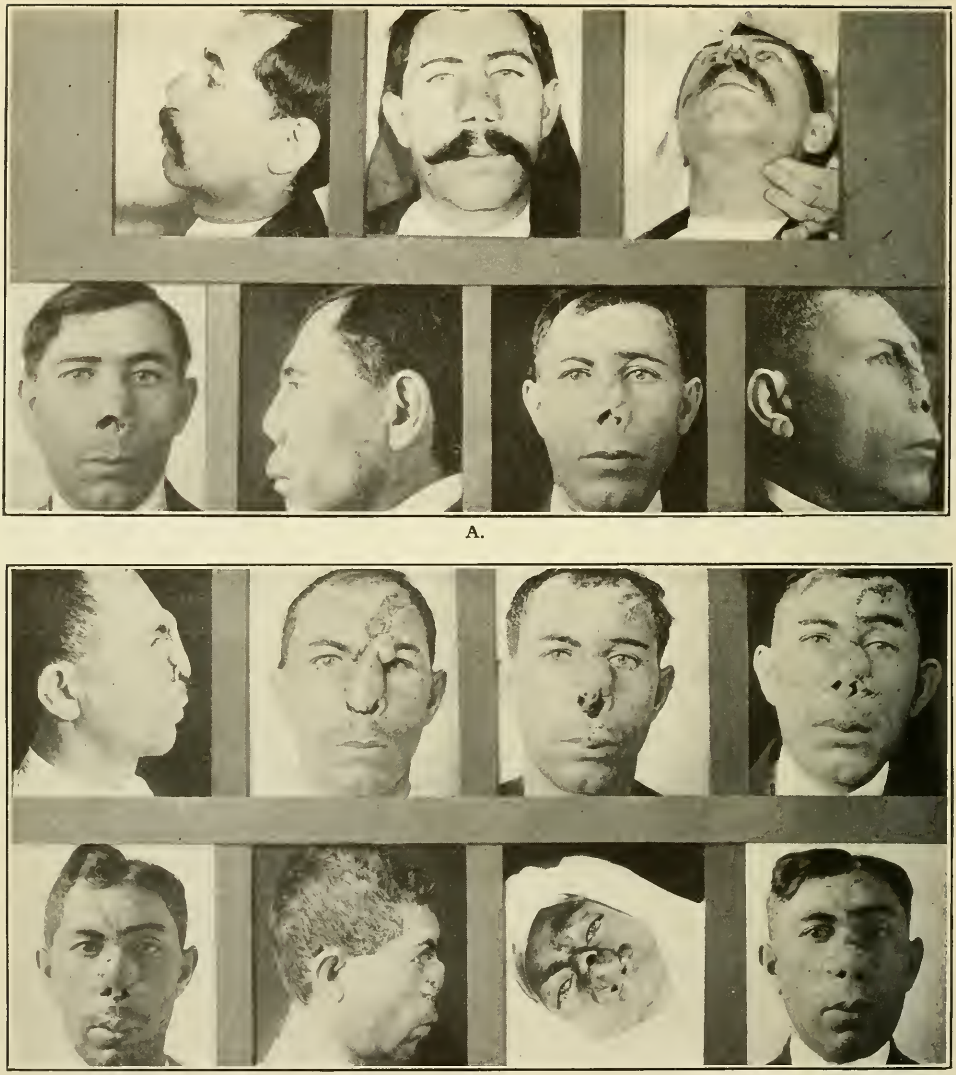

A. B. C. D.

FIG. 4.



A.

B.

Fig. 5.

I present this case as warning against the use of injecting paraffin into tissues. One never knows when he is going to strike a subject that will respond to the growth of a paraffinoma which may take on almost malignancy, causing terrific pain. Paraffinoma not only causes pressure on the nerves, but may produce a neuroma and a neuro-paraffinoma has been claimed to be malignant. Of course it is not so malignant as a sarcoma or carcinoma.

Case II. Case II came to me with the condition as shown in Fig. 3, A and B, the result of lues.

I proceeded in her case by reconstructing the nose from what was left of it, rebuilding the tissues from the neighboring parts (Fig. 3-B), and bringing it out so that I formed a sort of tip to the nose (Fig. 3-B). I made a hole above the tip of the nose (Fig. 3-C), and brought the tip farther down. A triangular flap was brought from the forehead sliding it down and uniting it to the tip of the nose (C). Now comes the further reconstruction of building up of this tip and making the flaps larger to bring the tip of the nose out. She had a perforation of the palate (Fig. 4-A) and wore a plate (B), which was so made as to push the tip of the nose out. When all reconstructive work is completed a permanent plate will be made with an appliance to supply the support lost through the lack of the nasal bones. She is now wearing an artificial nose made by Dr. Jesser, until further reconstructive work is performed. (Fig. 4-C and D).

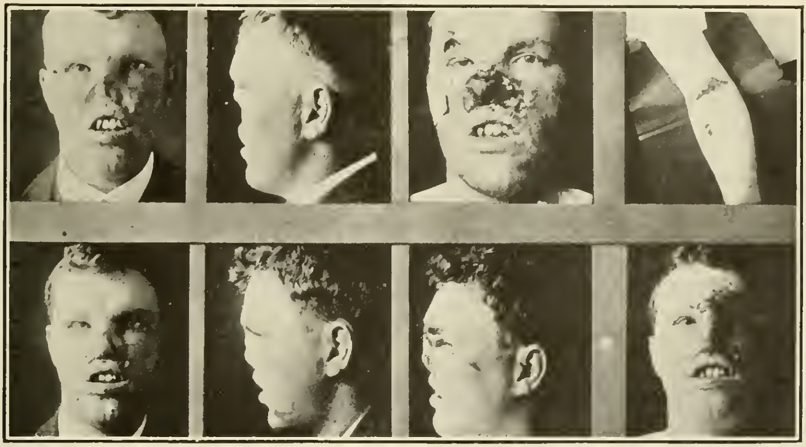


Fig. 6-A.

Case III. The next case I have to show is interesting on account of the pathology. This man came with a true tuberculosis of the anterior part of the nose, which had to be entirely sacrificed, both by surgery and radium treatment. (Fig. 5.) The tuberculosis was entirely cured. It is two years since the operation was performed, and now comes the reconstruction. It is a fairly good looking cosmetic nose, although not artistic. Nothing is more gratifying than the appreciation of these patients for what you do for them in a cosmetic way. It is their own nose, and no matter how beautiful a prosthesis may be they do not want it. They want their own nose. These pictures show as we have proceeded in this case the steps of the various operations. (Fig. 5.) This work consists of rebuilding constantly.

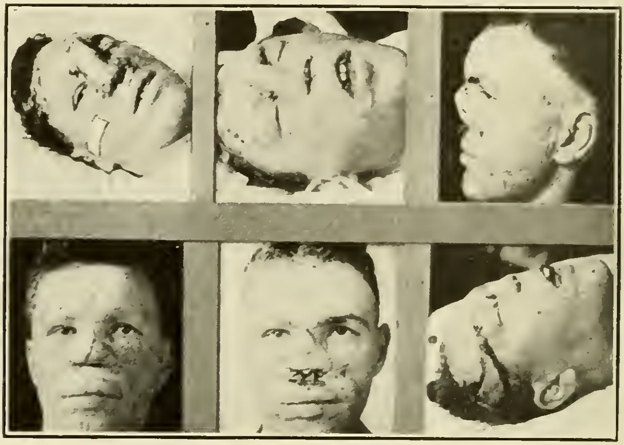


Fig. 6-B.

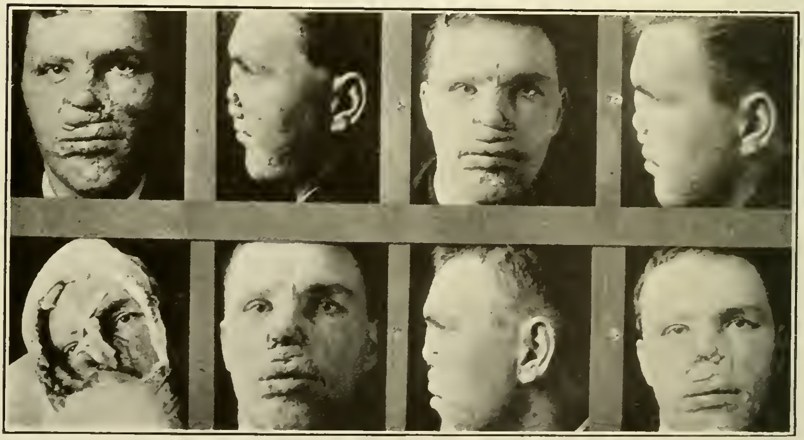


Fig. 6-C.

taking a little tissue from here and there. We are ready now to do a Wolfe graft, the nose having been lined inside and skin graft outside with fair nutrition. He is now ready to have the bridge and nostrils made.

Case IV. The next case is interesting from the standpoint of the etiology. When a child, this boy had some form of eczema or erythema, and the family physician by mistake applied a corrosive substance which destroyed the greater part of the nose as well as the eyelids and lips. As you see by the first picture (Fig.

6) there is no nose, and there is very much scarring of the lip and face. These pictures represent the number of operations to which he has been subjected to reconstruct what we have so far. He has a bridge to his nose, a little finger having been used to reconstruct the bony structure. He has an upper lip, which we made with a flap from his arm and portion of his eyebrow, which we transplanted from the back of his head, taking pieces of skin (Wolfe grafts) with hair and transplanting them.

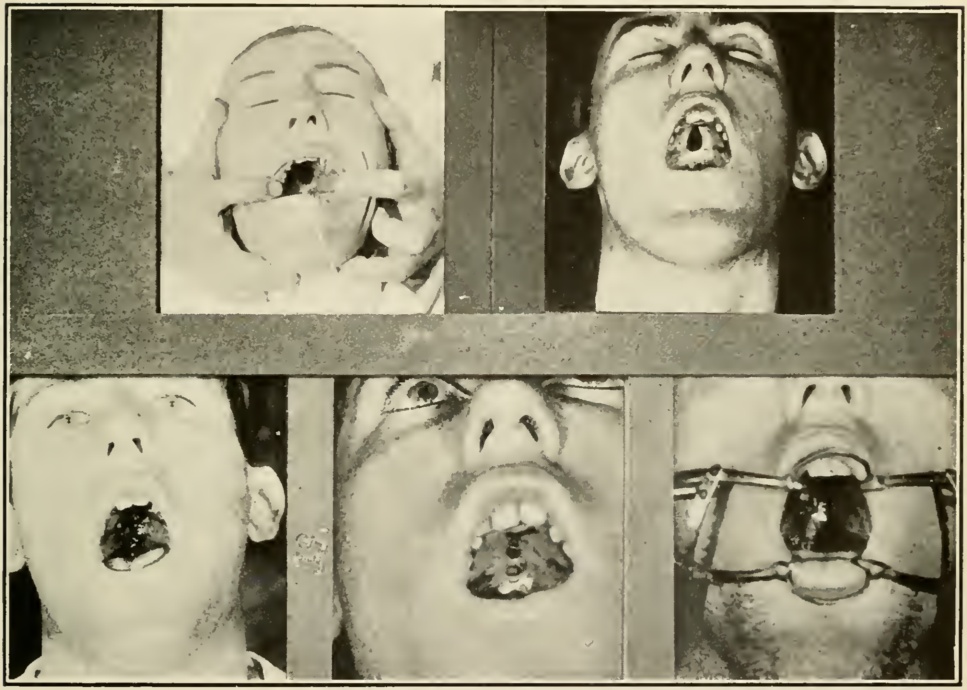


FIG. 7.

Some of these did not live, but others have remained. Recently we have made him nostrils. He has a septum, and we are using the inlays of rubber tissue until we have good sized nostrils, so that he can breathe through his nose. Next we shall make a columella.

Another interesting feature is the anesthetic. This man has had thirty-three operations, all done under general anesthesia. We must marvel at that, because his blood, urine, kidneys and heart were without any bad effects from the anesthetic, and this contributes something to science from that standpoint. The anesthetics were scopolamine and morphine with a slight amount of chloroform. The patient could not take a local anesthesia.

Case V. Fig. 7 shows a cleft palate case. The patient has been operated upon a number of times, cicatrization having taken place, making it impossible to do any shifting of tissue, as is usually done. He had a complete cleft which reached far over to the anterior surface near the teeth. I was able by the aid of Federspiel clamps to bring the parts together so that I united the uvula and rest of the soft palate. There was still a large anterior bony perforation which I failed to close, and this I recently succeeded in doing. He did not want to wear a plate, so that I devised another method by sacrificing the inferior turbinate. I removed half of the posterior end of the inferior turbinate and left it attached anteriorly, freshened the margin of the perforation and sutured the turbinate to the margin with wires. To my great satisfaction the turbinate healed in and closed the palate. In small perforations of the hard palate where the ordinary methods fail, this method should prove very useful.

Case VI. Here is a young man I show on account of the method used to reach a large tumor in the postnasal space, a fibro-sarcoma which I was able to reach through the palate by slitting the palate on one side of the uvula up to the hard palate, retracting, and delivering the tumor and then leaving the palate open for subsequent x-ray treatments.

While speaking about cleft palates I wish to say that no matter how well the palate is united, the patient never has the distinct voice which it is possible to produce with a prosthesis. Such patients do not seem to have occlusion of the postnasal space, even with all the intensive training which they receive, and their articulation is not as good as it might be.

Discussion.

Major Joseph D. Eby. When I was ordered to the colors in September, 1917, I reported to the School of Plastic Surgery in St. Louis, the first one of its kind, where one of our instructors was Dr. Beck. I had the pleasure as well as honor of obtaining a wonderful amount of information from him in that school. His work was demonstrated on several injected cadavers, freshly prepared, which showed all forms of rhinoplastic and other forms of facial plastic repairs. That was the laying of an excellent foundation for the work which materialized and came into my hands during the last two years of my career.

After the signing of the armistice I was ordered to the Walter Reed Hospital, Washington, D. C., which was designated as one of three institutions for the correction of maxillo-facial injuries. One of the institutions was shortly afterward closed. So, with my associate, it has been my honor and privilege as a young man and as an orthodontist to serve between 450 to 500 of our wounded boys who needed hospital attention.

Dr. Beck paid a well deserved compliment to Major Gillies, of England, and in our work we have received an abstract of the literature and have been brought in contact with many men who have treated maxillo-facial injuries. My present associate (Dr. Williams) spent several months with Major Gillies. Through Colonel Logan, I was brought into close personal contact with Major Gillies, the only essayist at the National Dental Association meeting last year, who spoke on maxillo-facial injuries and their treatment.

I feel in the light of my knowledge of the work done by our Allies, as well as by such men as Colonel Blair, Major Schaefer, and last, but not least, Lieutenant-Colonel Robert H. Ivy, of Philadelphia, our United States boys received as good treatment as the soldiers of any other nation from these great and skillful men, and the high character of the surgical and plastic work done shows that they need not take off their hats to anybody. (Applause.)

The operation which Dr. Beck spoke of as having been presented by Major Gillies in which pieces of osteoperiosteum containing a portion of the cortical process of the outer plate of the frontal bone are everted by means of a pedicle beneath a soft tissue pattern for nose replacement from the forehead, has been given the name by Major Gillies of the Indian operation, claiming that the Indians had long ago practiced rhinoplasty for certain injuries or deformities.

I did not receive any communication as to what the nature of Dr. Beck's paper would be and what ground he would very likely cover, hence some of my remarks may not be exactly relevant in discussing Dr. Beck's paper, but will refer to those conditions met with in war surgery.

We have acquired 1,500 photographic records of these patients, as well as innumerable wax colored casts and models of all forms. While the British and French literature is in advance of ours, I feel quite sure that within the next year, with the continued preparation of the work done in this country, you will find that a great number of very interesting things will be forthcoming and much better than I am capable of showing here.

An important question for consideration is the one of plastic repair of eyebrows from bullets particularly, as well as loss of substance. Colonel Ivy has been instrumental in making some partial repairs by cutting a small pedicle from the border of the hair line with the broadening of the pedicle, carrying the superficial temporal supply down by suturing the anterior three-fourths of the grafts to the desired position, thus establishing collateral circulation, and the pedicle being returned as much as possible to its original position. One or two slight secondary operations will improve the condition very materially, so that brow plastic is a most effectual means for the location of material.

In some instances of very high explosive fragments, the orbital socket is obliterated, or the orbit has to be enucleated, and some additional pedicle grafting is necessary to simulate the eyelids or to provide a sulcus to hold the prosthesis. We must figure on a slit border of a flap that has been thrown up to relieve the ectropium of the lid, and after slitting the border, comb the eyebrow, apply a graft, using some stiffening paste or wax, and a proper strip of material which will carry a heavy skin graft to replace the lost eyelashes.

We have had some remarkable plastic work done in the eye service in cases of phosphorus burns and smokeless powder burns. In some instances the eyes have been burnt terrifically.

I recall one case in which both upper eyelids were completely destroyed, with remarkable restoration following a plastic operation, and save for the absence of the orbicularis palpebrarum muscle and its function in the closure of the eyes, one would hardly realize that plastic repair had been made of the upper lid. This repair was done by everting a pedicle from the cheek so that collateral circulation was picked up, the flap excised and returned.

In another patient a high explosive fragment entered through the parotid gland region in front of the ear, traversed beneath the malar process and the zygomatic fossa and destroyed the nasal process to the right and left superior maxillary bone, and destroyed sufficient of the glabella to cause loss of support. The right superior maxilla is lost. The overlying skin was intact. The tip of the styloid process was saved. The scar was excised and redundant tissue everted into a flap.

There is a very intimate borderline between orthodontia in our study of facial cosmetics and in our ability to aid the plastic surgeon, and we should be perfectly familiar with the possibilities of his work in order that he may aid us. That such is true, we have an instance in this particular case.

We have several cases where the half of the missile was through the face, undermining the floor of the orbit, establishing double vision, not destroying the eye, in which we had to elevate the eye. We took cortical bone from the tibia, cutting a horizontal slot in the malar eminence and a corresponding nick in the nasal border of the superior maxilla, and the cortical bone inlaid in position to endeavor to sustain the weight of the eye. The cartilage in that instance would absorb by pressure. Stimulation of this tissue was sufficient. It was first essential to undermine a portion of the face; the entire middle curve of the face was cut into the least, and what the orthodontist could do was to provide anchorage for the nostril and hold it, and later provide a stage for modeling composition to hold a large flap of skin to epithelize the great raw surface.

Of all the wonderful things our beloved Dr. Case has done, his technic for taking impressions and making an artificial velum or soft palate restoration, is one of the best. In the same manner we secure remarkably accurate impressions, making a soft rubber bulb insert, and later a ridge containing teeth upon which a second insert can be snapped.

Where the tip of the styloid is involved in an injury, particularly where the missile has passed through the face and caused great loss, at the point of exit, such a case can be handled by the free grafting of fat taken from the abdomen or undermining the skin, or taking the fat from adjacent areas from the pedicle. There is no tendency toward growth of the subcutaneous fascia in the face or abdomen. It is a question always of not having to perform pedicle grafting by bringing skin from remote areas, with possibly excising scar tissue and undermining the adjacent skin and drawing it together.

In presenting these cases, I hope to impress you with the close relation existing between plastic surgery and orthodontia. There are certain cases in which the best results can only be obtained when orthodontic methods are employed to stabilize the parts during repair. If I have given you anything of interest I feel greatly repaid for coming here.

Dr. Joseph C. Beck. The cases presented by Major Eby are a revelation to me, because before I went to Europe I had no idea from my reading of the literature that there was such remarkable progress being made in orthodontia and in prosthetic work.

In my visit to the Walter Reed Hospital, Colonel Ivy was kind enough to show me everything he had. I met Dr. Schaefer in Baltimore; I visited Fort McHenry, and saw much of Dr. Blair's work in Jefferson. I spent a number of days in these different places to acquaint myself with what had been done in this war. I am sure, one thing that has been accomplished is a more thorough knowledge of mechanics in connection with the support of tissue for plastic surgery. Even now following the war, in the enemy country which I visited after the armistice, particularly Prague, they were not making use of the advances that had been made in plastic surgery. Among the advances that have been made are the osteogenesis that follows implantation and the tubal flaps of Gillies.

I want to correct Major Eby in one statement he made about the so-called Indian operation where he said the Indians were the ones that used these flaps. You will find in the literature that where a flap is taken from the forehead it is known as the Hindu operation.

I agree with what Major Eby said about American records of cases and the importance of their publication, and if the material that has been accumulated can be published in book form, it will prove invaluable to plastic surgeons and orthodontists.

Perhaps I ought to apologize for bringing this subject before you in such an unfinished manner, because had I known the discussion was going to be such as it has been, I would have brought with me reports of cases that have occurred in my own experience during the war, but I thought the subject I have presented and the cases I have shown would be of more interest to you.

The Principles of the Jackson Removable Appliance.

By Victor Hugo Jackson, M. A., M. D., D. D. S., F. A. C. D.,
New York City

Read before the meeting of the American Society of Orthodontists, Chicago, April 5th, 1920.

In presenting this paper, it is the purpose of the author to describe the more improved methods of practice in his treatment of orthodontia and orthopedia of the face, considering as far as time will permit, the general principles and advantages of the removable regulating appliances devised by him.

The first object in developing a new method of anchorage to the teeth was to perfect one which would permit the appliance to be removable and, at the same time, be securely retained.

A removable appliance is one that can be readily removed by the patient and by the operator for cleansing the teeth and the apparatus.

We are all familiar with fixed regulating appliances. They are anchored to the teeth in such a manner that they cannot readily be removed by the patient for cleansing nor by the operator for adjustment.

Recently, the whole profession and many patients have begun to realize the great necessity for the careful cleansing of the teeth being carried out systematically by the treatment known as "prophylaxis" and are becoming aware of the fact that, for that reason, regulating appliances and bridges of artificial teeth should be removable.

Realizing this necessity, the writer has spent most of his professional life in devising and developing such appliances as would help to prevent decay and save the teeth.

A few operators have been opposed to removable appliances. The opposition has been due principally to the careless habit of an occasional patient in leaving his regulating appliances out at times, which naturally would interfere with the progress of the regulating. However, by the use of a record card that the operator has at command, this practice would be readily detected and the condition corrected.

When the operator has discovered that a removable apparatus is not kept in place by the patient at all times, including time of mastication, as directed, he should immediately ligate the appliance to the anchorage teeth with wire, making it a fixed appliance, which generally can be done in a few minutes, and then direct the patient to return in four days for further adjustment of the appliance and for cleansing. At the same time, he should notify the parents that the ligating is necessary, as the conditions require that the force of the appliance should be continuous. In wearing the appliance ligated, the patient soon learns that it is not so pleasant to use a fixed appliance and make extra visits, as to wear a removable one, keep the teeth and appliance in a cleansed condition and make fewer visits. When necessary and well managed, this plan works well.

When rubber "equalizing bands" are used with a fixed appliance, the child is quite as apt to deceive the operator by leaving off the equalizing bands, which might prove as harmful as the leaving out of a removable appliance.

The removable regulating appliances to be described are made of spring-wire. They are so anchored to the teeth that they can be easily removed by the patient for the cleansing of the teeth and appliance.

For this purpose, the patient is directed to remove the appliance after each meal and before retiring. It can be quickly removed by the operator for making any necessary changes in its adjustment. The removable appliance is made on a model of the teeth in the laboratory.

When the model is accurate, the appliance should fit the natural teeth of the arch so well that there would not be any dressing or change required in its adjustment.

Appliances to Design.

Before designing a regulating apparatus, accurate models of the maxillary and mandibular arches of the teeth are made and thoroughly examined to determine how parts of an appliance can best be arranged to correct the irregularity.

All regulating appliances are designed from the study and measurement of the models and obtainable data regarding the regulating case. Pencil designs of the apparatus are made in a "duplicating" or a "triplicating" book; one copy of the design remains in the book permanently; another, with the models, aids the laboratory assistant in understanding the form of appliance to be made; and the third copy is utilized in cases of consultation, being forwarded to the consultant to assist in describing the plan of procedure and treatment.

Metals for Appliances.

Precious metals for making appliances have always been recommended by the author, but it requires much more time in making and repairing them, than when suitable base metals are used. He soon learned that some base metals have more spring properties and are found to be more efficient, as they are more resilient and persistent than others. The use of silver nickel, or German silver, springs has generally been found satisfactory. Its appearance is desirable as it is near the color of platinum, which is much less conspicuos than gold. This would prompt its continued use. Polished gold can be seen at a considerable distance from the patient, which with some would be objectionable.

Another important reason for recommending base metals is that springs can be more quickly united with chemically pure tin as a solder than with gold, and can be unsoldered for changing the relationship of the pieces in a few minutes without drawing their temper or otherwise injuring them. This does not follow when gold solders are used.

Phosphobronze.

Phosphobronze of good quality is a satisfactory spring metal. It is similar to gold in color but is useful for making springs and spurs for orthodontic appliances. In use it holds its color well and is more springy than the metals described. When well drawn, it is tough and suited for much longer service than any of the metals mentioned. This is owing to its resilience and persistence. In time, all metals lose their springiness and come to what is known as a "stand." The metals above mentioned usually come to a stand much sooner than the phosphobronze. It is claimed that now there is no lead in its composition. Chemically pure tin, as a solder, has more affinity for phosphobronze than for most other metals, thereby making a stronger union. In use there is no special chemical action apparent nor waste around the springs.

Gold Partial Clasp Metal.

After much experimentation the writer succeeded in forming a partial clasp metal made of 18 karat gold rolled plate, ¼ on German silver, 36 U. S. standard wire gauge. In making an appliance, the gold side rests against the tooth, while the solder, chemically pure tin, is applied on the German silver side, because it has more affinity for the German silver than for the gold. The 18 k. gold as purchased in the market was at one time recommended by the writer for partial clasps but it was found that, after being in use for a time, it would peel from the solder.

Light Colored Bronze.

Partial clasps made of light colored bronze spring plate, No. 36 gauge, have been used in certain cases for several years with thorough satisfaction. When used for partial clasps and other parts of an appliance, as resting on the gum, etc., the metal keeps bright like gold and does not encourage fermentation, nor stain the teeth. In practice, however, the writer is continuing to use the gold partial clasp metal.

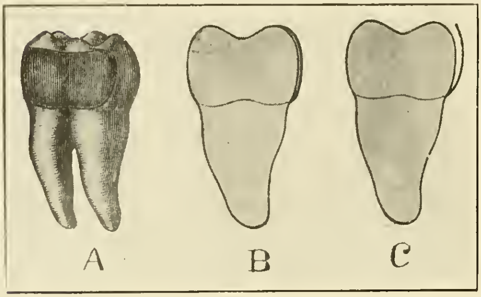


Fig. 1.

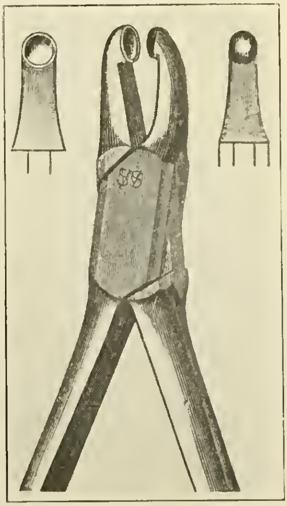


Fig. 2.

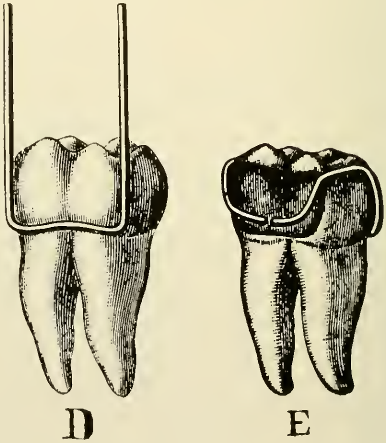


Fig. 3.

Author's Method of Making Appliances.

The author will describe as in previous writings, his general plan of making regulating appliances, first speaking of the principal parts of an appliance and their purposes and also his method of uniting them with solder.

The general parts of an appliance are partial clasps, spring clasps or wire clasps, base wire, spurs and springs. These are usually united with chemically pure tin as a solder.

In making a regulating appliance, an accurate model is necessary. Any molar or premolar teeth that are not fully erupted but are to assist in the anchorage should first have a groove cut in the plaster of the model beside the tooth toward the neck for the adjustment of a partial clasp to project under the gum to strengthen the anchorage. This is usually done with a rather straight hoe excavator. The operator must be sure to preserve the natural shape of the tooth and not remove nor injure the plaster representing the gum on the lingual side of the groove as, in soldering, the solder is liable to run into this injured part, which would cause the appliance when inserted to rest on the gum, while the thin partial clasp would pass between the tooth and gum without causing irritation.

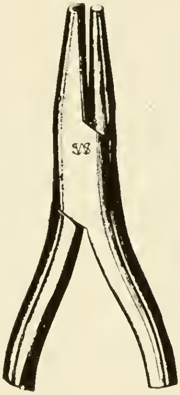


Fig. 4.

Partial Clasp for Anchorage.

A partial clasp is made of plate metal No. 36 U. S. standard wire gauge, being of sufficient size to fit the lingual surface of a tooth used for anchorage. (Fig. 1-A.) It is contoured with a contouring plier having the end of one beak cup shaped and the other formed to fit it. (Fig. 2.) The partial clasp is always overcontoured to cause it to rest on the tooth at the neck and near the grinding surface. (Fig. 1—A, B, C.) A partial clasp is arranged to fit the lingual side of each anchorage tooth, as to two canines or premolars and two molars in each arch. When connected by a base wire in this manner, the anchorage is quite complete, but with the improved anchorage, it is generally found advisable to have also partial clasps arranged on all of the teeth in the lateral maxillary divisions of the arch, that is—the molars, premolars and canines.

Clasps for Anchorage. There have been various forms of clasps devised by the author for anchoring regulating appliances, many of which have previously been described. Following are some of the ordinary examples:

Spring Clasp. A spring clasp (Fig. 3, D, E.) is usually made of spring wire No. 19, 20 or 21 U. S. standard wire gauge shaped with a clasp-bender (Fig. 4) or a round-nosed pliers to fit the buccal surface of an anchorage tooth near the gum with both ends formed to pass over the arch at the junction of the two adjoining teeth to rest on a partial clasp and be attached with solder. It is then known as a spring clasp attachment. (Fig. 3-E.)

Wire Clasp for Anchorage. A round wire clasp is used in any part of the arch. For clasping a molar it is generally arranged to extend from the appliance around the last molar of the arch to rest on the buccal surface near the gum, or it is arranged to pass from the appliance over the arch at the junction of two teeth to rest on the buccal surface of a tooth as a molar, premolar, or canine. The wire clasp is usually preferred when the conditions are favorable as, when the teeth are well erupted, etc., it can be used without collars but, when the teeth are not well erupted, collars with lugs cemented to the teeth should be employed.

A flat clasp made from plate metal has its advantages. It can be shaped to pass between the teeth when desired, at any favorable location for anchorage and, at the same time, extend from the apparatus to rest on the buccal side of a canine, premolar or molar, as described.

Locking Device. A locking device for an appliance will be mentioned here and more fully referred to later. It has a collar with a buccal lug resting near the gum, cemented to a canine or a premolar and to a molar on each side of the arch. A wire clasp is formed to extend from the appliance over the arch in front (or back) of the canine to engage with the buccal lug, on each of the collars on the canines and the molars, with the ends of each of the clasps terminating in a hook. This form of anchorage is suited for supporting an apparatus for any class of irregularity of the teeth.

Base Wire. A base wire is the foundation of a regulating appliance. It is a large spring wire of good temper, usually made of German silver, silver nickel, or phosphobronze. It can be made of any suitable spring metal. The base wire may be a rigid or a spring base wire. There are four general forms of base wire—lingual, palatal, palatal with loop, and labiobuccal. The base wire is divided into a body and arms. It should be sufficiently strong and rigid, so that it will not be sprung from its normal position, when necessary force is exerted by strong springs which are attached and extended from it for any purpose in moving the teeth.

The base wire should not interfere with the action of the tongue nor with the voice articulation. In the maxillary arch, the body of the base wire should rest in the posterior part, where the tongue exercises the least motion and where the patient would be least conscious of its presence. For the mandibular arch, the appliance should be arranged in a similar manner, the body resting below the margin of the gum.

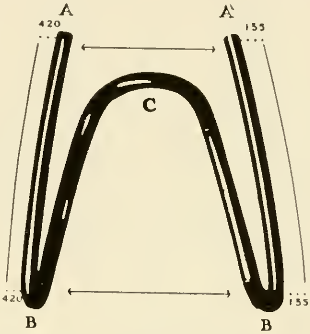


Fig. 5.

The different sizes of base wire generally recommended are:

For children between the ages of 3 to 6 years......	No. 13 gauge.
For children between the ages of 6 to 10 years	No. 12 gauge.
For persons between the ages of 10 to 20 years......	No. 11 gauge.
For persons between the ages of 20 to 30 years......	No. 10 gauge.
For more mature adults, a more rigid base wire....	No. 9 gauge.

Fig. 5 shows a lingual spring base wire for expanding laterally the mandibular arch. It forms the framework or body of a regulating appliance to which springs are attached for any purpose. It is made the same general shape as the base wire with loop for expanding laterally the maxillary arch to be described.

It is formed to follow the lingual curve of the arch just below the margin of the gum back of the incisors and extends backward and downward to the last molars where the ends are bent in a medium-sized curve upward and forward, thus forming arms to rest on partial clasps arranged on the lingual side of the anchorage teeth, to which they are soldered with the wire clasps or spring clasps, spurs and finger springs.

The action of the appliance is caused by adjusting the arms of the base wire according to the part of the arch requiring movement. For expanding laterally the *anterior* part of the arch, the ends of the arms, "AA," are pressed outward by the hands, or by an expanding plier, thus bending the base wire at "BB." For expanding laterally the posterior part of the arch, the parts of the appliance at "BB" are pressed outward bending the base wire at "C."

Each change of added force for the lateral expansion of the arch should generally be made once a week and the change limited to one millimeter. The principle of applying the force is illustrated as follows: The arms of the appliance "AA" are first to be forced outward bending the base wire at "BB" to cause the outer surface of the arms to rest at the dot-marks as indicated at 0 and 1, for the first application of force; again the arms are pressed outward to rest at the dot-marks 1 and 2, for the second application of force, and for the third application to rest at 2 and 3; for the fourth application to rest at 3 and 4; for the fifth to rest at 4 and 5, etc. The same principle is employed in adding force for expanding the posterior portion of the arch. It is noted that each measurement of force is alternated on the record card, first making the record of measurement on one side of the arch and then on the other as indicated by the numerals, that is, never making the measurements on both sides of the arch at one time, although the springy base wire can be shaped to expand both the anterior part of the arch "AA" and the posterior part of the arch "BB" at the same time, and a record made.

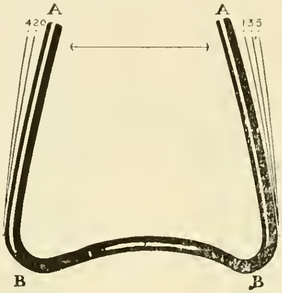


FIG. 6.

Palatal Base Wise.

In the study of the form of the dental arch, it is often predetermined that the distal part of the arch is broad enough.

In practice, it is that found in cases requiring lateral expansion of the dental arch, a less number need expansion of the posterior part of the arch, either maxillary or mandibular.

In making a regulating appliance, when only the anterior part of the maxillary arch requires lateral expansion, a base wire known as a palatal base wire (Fig. 6) is arranged to cross the posterior part of the arch where it is broad enough, usually opposite the last molars.

The palatal base wire is always shaped to follow the palatine vault of the dental arch, with the ends bent forward to extend to the canines. Arms are thus formed which rest on partial clasps, usually arranged on the lingual side of each of the molars, premolars and canines.

The arms are the foundation and anchorage portions of the appliance. The ends of the metal arms are tapered by filing to make them less bulky. They are soldered to the partial clasp with the ends of the spring clasps and finger springs; arranged in this manner the ends of the arms are bent outward at regular intervals to expand the arch in the region of the canines and premolars, force being caused by pressing outward on the ends of the arms "AA" which bends the base wire at "BB," following the systematic plan of progressive movement by steps ar indicated by the numerals as 0 to 1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, etc.

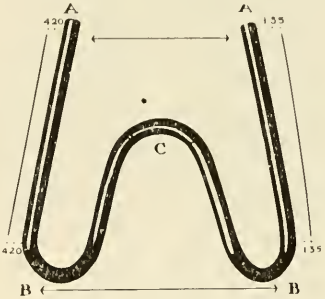


Fig. 7.

The apparatus with the palatal base wire following the palatine vault of the arch as described, is not intended to expand the posterior part of the maxillary arch as the palatine curve of the base wire should never be straightened nor changed for that purpose. It would have more tendency to tip the teeth in their sockets than when a palatal base wire with loop is employed.

Palatal Base Wire with Loop.

When the maxillary arch needs general lateral expansion, a palatal base wire with a U-shaped loop is employed (Fig. 7). The apex of the loop "C" should always rest deep in the palatine vault, with the sides of the loop extending backward, following the deeper lines of the vault and forming a rather broad outward curve toward the molars on each side of the arch as shown at "BB" with the ends extending forward forming arms "AA," the arms to be shaped and soldered to partial clasps on the anchorage teeth. These curves of the base wire "BB" should usually rest distally, a little beyond the line of the last molars of the arch in order to give added length to the portions of the loop from "C" to "BB" to cause the base wire to be more springy.

This base wire is similar in form to a lingual base wire, and its action is about the same.

For expanding the anterior part of the arch the ends of the arms "AA" are pressed outward, bending the base wire in the distal part of the arch at "BB."

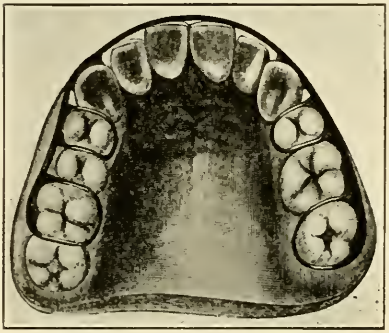


Fig. 8.

When the distal part of the arch needs expansion, outward pressure is exerted on the sides of the distal part of the appliance at "B" which bends the loop of the base wire at "C" increasing the width of the loop. These changes should always be governed by the added measurement as indicated on a record card described.

An appliance with this form of base wire is adapted for the lateral expansion (or contraction) of either the anterior or the posterior part of the arch as needed, and the expansion can be carried to any desired limit, as with the mandibular arch. This, the writer thinks has not been accomplished as accurately with any other single device.

Labio-Buccal Base Wire.

A labio-buccal base wire has been used many years in expanding the arch and for moving individual teeth. It is a curved bar located on the labial and buccal sides of the dental arch sustained by entering tubes, eyelets or hooks on collars cemented to the teeth, or by spring clasp attachments. The labio-buccal base wire is used for moving the teeth as by ligatures, extending from the bar around the teeth, by attached springs, etc. For retaining the teeth it may be sustained by spring clasp attachments or by spurs projecting from the base wire to enter tubes, eyelets, or hooks on collars or by spurs projecting from collars cemented to the teeth. (Fig. 8.) Its size varies according to the force desired. For many years the author used labio-buccal base wires of various forms, as a plain base wire, or a base wire with corrugations, U-shaped loops, etc. The base wire with loops is often the most serviceable.

The palatal and lingual base wires previously referred to are adapted to the particular purpose needed. It will be noted that they are generally of rather large diameter and purposely made stiff, to serve as a foundation for the regulating appliance and to prevent the teeth from moving back and forth in their sockets, as during mastication, while being regulated, and while being retained. In this manner tenderness is avoided. Often when the teeth are supported only by a small spring, they are easily disturbed in their sockets and become more or less tender, delaying new bone deposits, and consequently there would be an inclination on the part of the patient to avoid necessary normal mastication. Accordingly, with the former plan, there is less tendency to excessive absorption of the alveolar process and less irritation and general tenderness of the teeth than when small springs are used. As noted, the action of the large spring base wire is controllable and the extent of each movement is limited as desired.

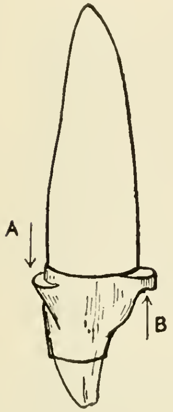


Fig. 9.

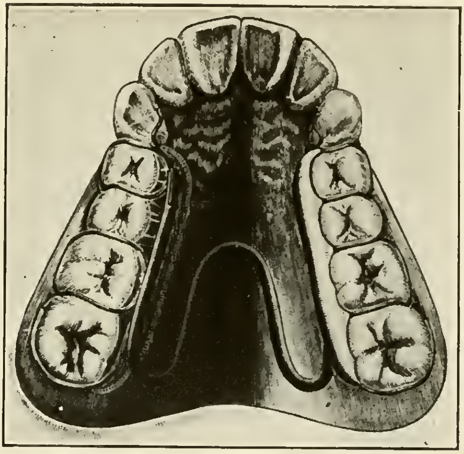


Fig. 10.

Springs. Springs for moving the teeth as referred to, are made of silver-nckel, phosphobronze, or spring-gold. Any suitable spring metal desired can be used. The sizes usually employed are Nos. 18, 19, 20, or 21 U. S. standard wire gauge.

Springs are usually named according to their shape, position or purpose, as finger springs, loop-shaped springs, semicircular springs, etc., several forms of which are shown in this paper.

Spurs. The appliance is arranged so that it will be supported by the teeth to prevent it from resting unduly on the gum tissue. For this, a wire spur (Fig. 16) is attached to the body of the apparatus and shaped to extend and rest usually on the crown of a molar and a premolar on each side of the arch.

Another method of supporting the appliance which is superior in some respects for this purpose is to attach a shelf on the lingual side of each collar used for the anchorage locking device, the spur or shelf being attached to the gingival edge of the collar near the gum line. (Fig. 9 and Fig. 16B.)

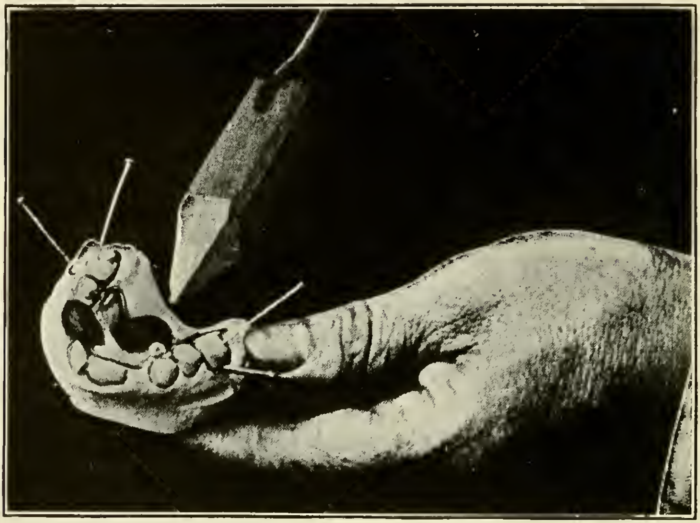


FIG. 11.

A similar shelf is also used in case of close occlusion of the teeth and for moving teeth bodily. The shelf is usually made of plate metal about 28 gauge, arranged to project from the collar about two millimeters, the parts being properly fitted and soldered in the usual manner. The collar is then cemented to the tooth and a model made representing the collar and shelf in place.

The appliance is designed and the parts arranged on the model to rest on the shelves with the wire clasps extending to the buccal side to complete the anchorage.

When a regulating appliance has been designed, the different parts are always shaped to the model and then assembled, to be united by solder. (Fig. 10.)

Soldering.

In soldering, the base wire, spurs and springs are usually held in position for the soldering by moldine and, when necessary, further sustained by pressing steel pins by the side of them into the model. (Fig. 11.)

Solder. Chemically pure tin is usually employed as a solder in uniting the parts of the appliance, the tin being fused with a large soldering iron. Before soldering, the parts are fluxed with chloride of zinc or with a no-korode flux.

Knowing the detrimental systemic effects of lead, the writer early became convinced that in making these appliances it is not wise to use a solder that contains lead, but he wishes to say that he has never known of any case where harm resulted from the use of such a solder.

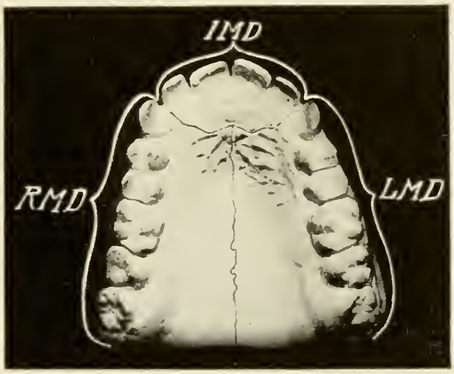


Fig. 12.

When lead is excluded from the metals used in an appliance, it has also been found by long experience that there is less chemical action caused in acid mouths and consequently less oxidation or tarnish of the appliance.

The practice of gold plating or gilding a regulating appliance made in this manner is generally objectionable, as gold, chemically deposited on the whole of an appliance is porous and when bathed in saliva sometimes develops a chemical action, which causes the metal to tarnish more than when no plating is employed. However, when gold plating is to be used, it is usually advisable first to apply a coating of copper and then a good coating of gold.

Divisions of the Dental Arch. In the study of the dental arch for the purpose of orthodontia, as for expanding the arch or bringing about any necessary correction in the position of the teeth or for any other purpose, the writer has found it an advantage to divide the arch into three divisions, sections, or segments; (Fig. 12) as, the right maxillary division, the left maxillary division, and the intermaxillary (or invisive) division.

These divisions of the maxillary arch are the natural divisions as separated and distinguished by the lines of the premaxillary and intermaxillary sutures. The intermaxillary division contains the four incisor teeth. Each lateral division of the arch includes the canine, premolars and molars. The divisions can be symbolized as follows:

R-M-D
L-M-D
I-M-D

To complete this system for study, record, and convenience the mandibular arch is separated into similar divisions.

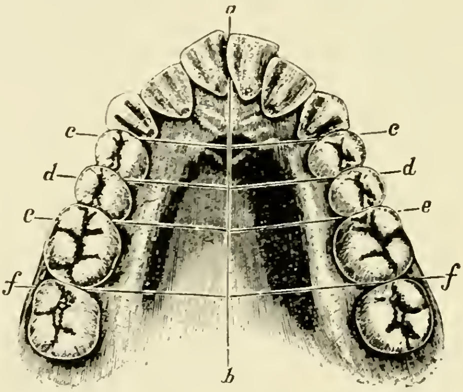


Fig. 13.

Accordingly in the examination of orthodontic cases, one should determine in what division of the arch the irregularity is located.

The regulating appliances described are also divided into three divisions, constructed to deal with the irregularity presented in each division of the arch.

When the teeth are irregular, they are usually much crowded in the arch. This is most generally evidenced by there being insufficient space between the canines for the proper arrangement of the four incisors.

Many operators are making a mistake in expanding the dental arch to provide room for the incisors by moving outward the premolars and molars without moving outward at the same time the canines, which are included in the lateral maxillary divisions of the arch.

Fig. 13 is prepared to illustrate the lines of movement of the teeth in properly expanding the arch laterally. It shows that the movement of the molars and premolars in a buccal direction, as illustrated by the lines, "C, D. E and F," does not increase the width of the arch anterior to them as required.

Therefore, in expanding the dental arch laterally, the appliance should always be arranged to include the canines, if present. With these conditions presented in such a large majority of cases, it has been necessary to devise a standard appliance, strong and complete in itself, that is definite, thoroughly efficient and which can be handled. It must have a strong foundation to which springs are attached, for sustaining the anchorage and for individual tooth movement.

Analogy.

To impress upon the mind the analogy between removable regulating appliances and the human body, the author will refer to the many necessary mechanical features embodied, their capability and their impressive similarity in form and action, an understanding of which he is sure will prove instructive and beneficial.

The base wire is the foundation or body of a regulating appliance. As previously stated, it is made of large spring wire. The portion of the base wire connecting the lateral divisions of an appliance is always rather large and strong; the ends are bent to project forward, (or backward), like arms; they are shaped to rest on the partial clasps, usually on the lingual side of the anchorage teeth.

The base wire or body may be compared to the human body with the arms extending forward from the shoulders, as the arms of the base wire extended forward from its body or shoulders. There are fingers on the ends of our arms and, likewise, there are metal fingers arranged to project from the ends of the metal arms of an appliance in the form of springs.

Therefore, in making a regulating appliance, it is essential that it have a strong body, strong arms, and strong fingers, as each is to do a definite work. They should be large and strong enough to move the teeth a definite distance in a given time and not move the teeth further than intended.

If a man be not strong enough to accomplish promptly the work laid out for him, a stronger man is employed.

Following the same idea, one would make a regulating appliance strong, always having it built strong enough to cause the arms and fingers to act definitely in making the desired movement of the teeth and process.

Again, the human body performs all movements by muscular action; in effect, this is similar to the action of the spring parts of the regulating appliance.

The fingers of the human body grasp objects and move them definite distances with ease, following the command of the will.

The plan of this system of regulating is to have an appliance built sufficiently strong and so thoroughly anchored, as to move the teeth in the desired direction, in a limited time.

The analogy mentioned will be apparent in the study of the different appliances presented, thus making some of the details in their description more readily understood.

In designing an apparatus for moving the teeth, one would generally be led to adopt correct forms of metal arms and fingers, etc., by first shaping his finger as he would to move a similar object.

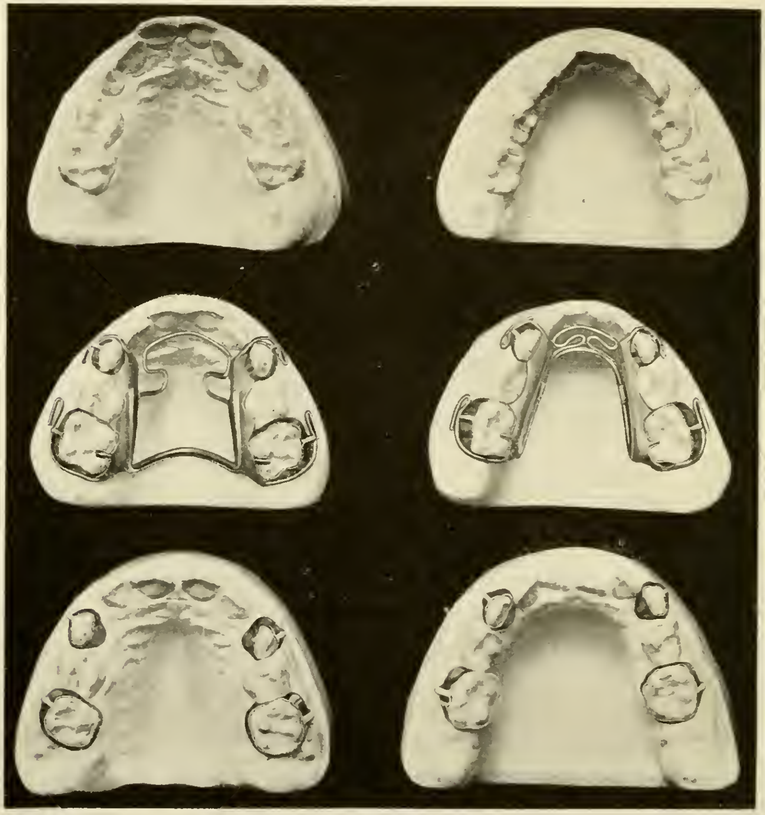


FIG. 14.

Orthodontia an Exact Science.

Orthodontia has been recognized as a science, but it is desirable that the different phases of orthodontia be so thoroughly understood as to reduce it to an exact science and that the mechanics be so simplified that any operator of steady judgement can perform at least ordinary operations without overtaxing his mechanical skill.

Record Card.

To secure accuracy in applying force for the regulation of the teeth, several years ago, the author devised a method of making a careful pencil-tracing on a record card of each regulating appliance in use before applying force, and indicating on the card a record of the amount of each subsequent change in the appliance for moving the teeth. This would be a permanent record of the changes of force applied and the date of the change.* The plan is further referred to in the following.

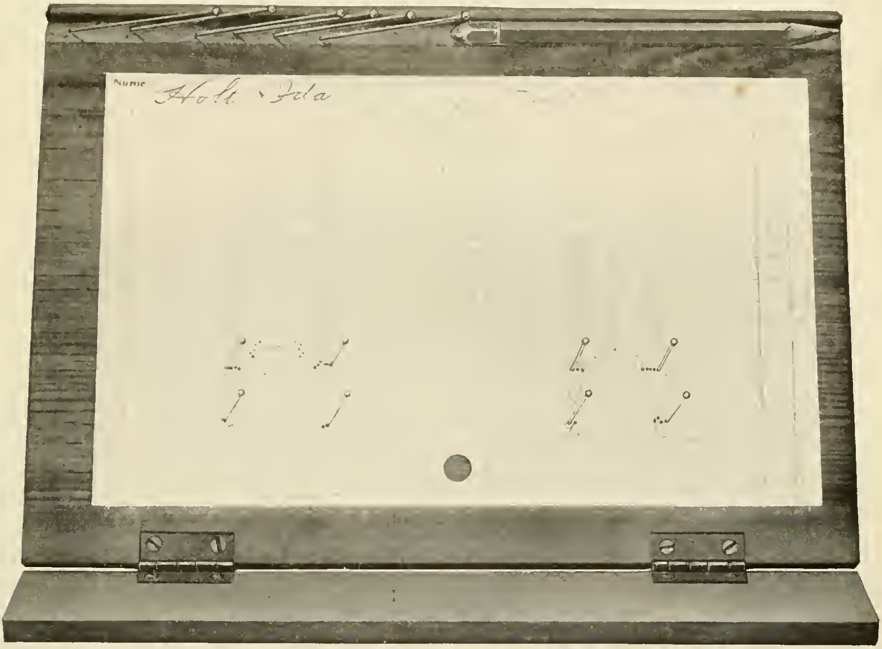


FIG. 15.

Fig. 14 illustrates a case with narrow arches and distal occlusion with a maxillary and a mandibular appliance made as previously described and utilized for expanding and equalizing the arches for a child four years of age. The maxillary appliance has a palatine base wire; the mandibular appliance a lingual base wire; force is caused by bending outward the arms and adjusting the springs of each appliance by rule. With these appliances shown, force for the lateral expansion of the maxillary arch would be caused by grasping with the hands the front end of the arms of the appliance and pulling outward, thus bending the base wire slightly, which, when inserted in the mouth, would cause force to expand the front part of the arch. In applying force for the lateral expansion of the mandibular arch, the front ends of the arms should be pulled outward. This would bend the base wire at the curves opposite the molars which would effect the expansion of the front part of the arch. For expanding the distal part of the arch, one would pull outward on the sides of the distal end of the appliance, which would bend the loop of the base wire as necessary.

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*Jackson's Orthodontia, 1904, page 113.

Each of the mentioned changes of form would be governed by the successive measurement indicated on the record card.

As stated, a record of the amount of each application of force applied is recorded on the ruled record card. (Fig. 15.) When in use this card is supported by a tracing board which usually has a hinged ledge, or shelf, for folding over the lower edge of the card. In registering the shape of the appliance it is placed on the card against the edge of the ledge.

With a sharp pencil a tracing is made of the outer contour of the arms and springs of the appliance. A steel pin 1¾ inches long is then pressed through the card into the board close beside the arms in the location of each of the canines and molars used for anchorage. With a sharp pencil the prick marks in the card are blackened. When force is to be applied, another prick mark is made, usually one millimeter from the first, in the direction it is intended to bend the arm or spring of the appliance, for causing force. The indicated pin punctures are a permanent record of the successive applications of force, generally of one millimeter. The arms of the appliance are bent outward to rest against the pins after the added measurements. Each of these indicated changes of force is known as a "step." The first step, generally being one-half millimeter, later one millimeter, should be made at intervals of once a week. When the regulating is advanced considerably and it is desirable, visits may be made once in two weeks or even at longer intervals.

In some cases, it is wise not to advance in the movement too rapidly, although a change of more than one millimeter is often made without discomfort to the patient. In the expansion of the arch laterally, it generally requires a change of only a few millimeters. From each step recorded on the record card, a line is extended upward for recording the date of the change.

The card is ruled from above downward, forming columns, and the date of the change in the appliance is made to agree with the new tracing and is inserted in the column at the right.

A light line is drawn from the date to the dot mark, which completes the record of the change that is made.

Every subsequent change in the shape of the appliance is recorded by one or more dot marks as required and the date noted in the column in the same manner with a line connecting them.

If a change is made in two or more springs on the same date, the lines extending from the dot marks to the date should converge.

With an appliance supported with spurs as referred to, there would be no pressure caused on the gum tissue and by following the plan of the record card, that is, indicating only short distances or steps by the dot marks, and leaving an interval of seven days between visits, the patient can be assured that there will be no pain nor special discomfort in the regulation of the teeth.

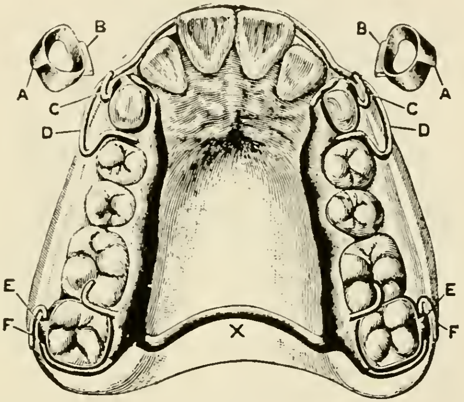

Fig. 16.

Generally, only a few definite steps on the record card and corresponding changes in the appliance are required to move the teeth as far as desired. Changes for the application of force should never be made by guesswork but always according to the record card.

The writer will now refer more particularly to the improved method of anchoring regulating appliances for the equalizing of the maxillary and mandibular dental arches, and which method may be utilized for causing all necessary movements of the teeth.

Making Appliances.

To make these appliances (Fig. 16) a broad collar with a buccal lug located to rest near the gum in the center of the tooth is cemented to each of the maxillary and mandibular canines, "AA," and a broad collar with a buccal lug located near the gum is cemented to each of the maxillary and mandibular distal molars of the arch "EE."

After the collars are cemented in place, accurate plaster impressions of the teeth and models are made; the models represent the collars with lugs or tubes in place.

In making an appliance for the maxillary arch, partial clasps are arranged on the lingual side of the anchorage molars and canines, the partial clasps resting on the collars represented in plaster and, when desired, partial clasps are also arranged on the intervening teeth.

When the distal part of the arch is broad enough, a palatal base wire "X" is planned to cross the arch opposite the last molars with the arms extending forward and shaped to rest on the partial clasps arranged on the lingual side of the anchorage teeth.

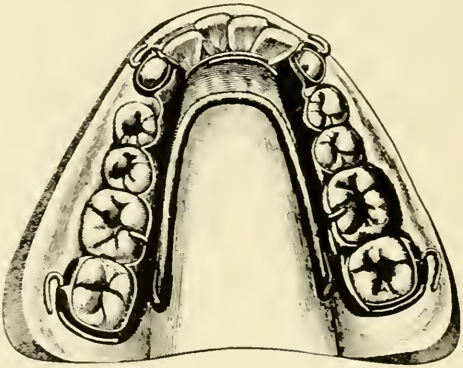

Fig. 17.

The appliance is retained to the teeth by wire clasps which are soldered with the partial clasps, spurs and ends of the semicircular spring to the arms of the appliance with chemically pure tin by using the soldering iron. Two wire clasps "FF" are shaped to extend from the distal part of the anchorage portions of the appliance, one on either side, to clasp the second molars chosen for anchorage. The free end of the clasp is made to pass above the lug "E" on the collar and bent backward upon itself, forming a rather long hook.

The wire clasps "CC" attached to the anterior part of the anchorage portions of the appliance, one or either side, are shaped to extend over the arch at the junction of the lateral incisor and canine. They fit well in the groove and reach near the gum line on the buccal surface of the canine, where each is bent backward in a curve to pass above and engage with the lugs on the collars located in the center of the teeth. The end of the clasp is curved forward on itself, forming a hook.

The wire clasp passing above the lug on the collar for anchorage completes the locking device of the appliance. In this manner, the appliance is held firmly in position for causing any movement of the teeth.

The appliance is easily removed by unhooking or unlocking the clasps from the lugs with the finger, which liberates the appliance. This can be done either by the patient or the operator.

The hook-shaped end of the clasp makes it the best form of attachment to grasp with the finger nail for unlocking the appliance.

A hook of this shape is thoroughly suited for the adjustment of rubber equalizing bands as for the correction of protrusion of the maxillary arch or for a prognathous mandibular arch.

By the use of an appliance with a palatine or a lingual base wire and a correct tracing to direct the changes, the expansion of the arch is made easy and progressive, step by step, in the manner described in connection with the record card.

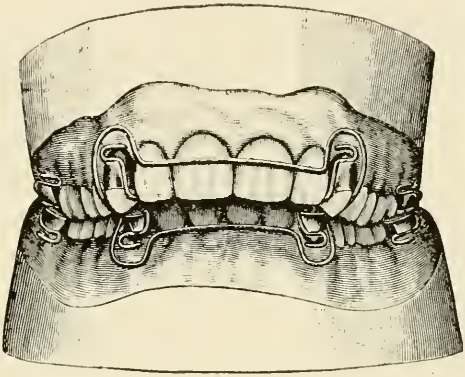

Fig. 18.

An appliance for the expansion or the equalizing of the mandibular arch is made with a lingual base wire No. 10, 11 or 12 gauge. (Fig. 17.) It is anchored to the teeth with wire clasps. The locking device is arranged the same as in the maxillary arch for retaining the appliance.

A lingual base wire is shaped to follow the lingual curve of the arch. The front part, back of the incisors, rests just below the gum line and extends backward and downward to the posterior molars where the ends are curved forward, extending to the canines, forming arms to rest on partial clasps arranged on the lingual side of the anchorage teeth.

The ends of these arms are tapered by filing, so that the front anchorage portions will not be bulky, but they are kept sufficiently large to retain their strength.

The arms are soldered with the other parts—partial clasps, wire clasps, finger springs and spurs as described.

Curved finger springs, as shown, are often utilized in reshaping the line of the incisors between the canines.

The appliance is removed by disengaging the wire clasps from the lugs with the finger.

Fig. 18 illustrates a front view of the maxillary and mandibular dental arches with the teeth in occlusion after correction, on each of which the appliance is arranged in position.

The plan of the locking device for anchorage and the semicircular springs of the appliance for moving the incisors are especially shown.

Equalizing the Dental Arches Antero-posteriorly.

Fig. 19 shows the original occlusion of the teeth in the case just described and illustrated by Figs. 16, 17 and 18. It shows the receding mandibular and maxillary protruding arches with appliances in place for their correction, by equalizing the dental arches. Fig. 18 shows the case after treatment.

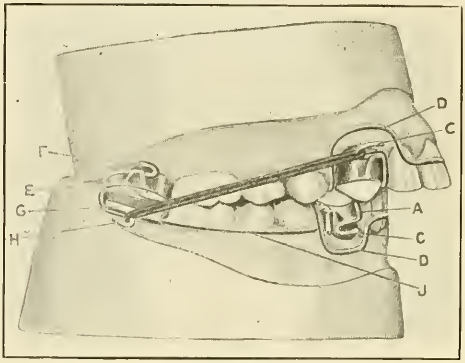

Fig. 19.

By the term "equalizing the maxillary and mandibular dental arches" is meant the making of the unequal arches equal, so that the teeth of each arch will occlude normally with the teeth of the opposite arch.

In equalizing the dental arches, antero-posteriorly, the distance between the maxillary canines generally needs to be increased to properly accommodate the four maxillary incisors and to permit the mandibular arch to be moved forward as it should be and the maxillary arch moved backward as necessary.

It often occurs in cases of this type of irregularity that the maxillary or mandibular incisors are too prominent and need to be moved inward to complete the equalizing. This is generally accomplished by the use of a semicircular spring with U-shaped loops, shown at "DD," arranged to pass in front of the incisors with the ends of the loops attached to the anchorage portions of the appliance.

Added force is caused by closing the loops of the spring slightly at a time.

Should the mandibular canines occlude detrimentally with the wire clasps of the maxillary appliance at any stage of the regulating, the clasps could be changed to pass from the appliance back of the maxillary canines and rest above the lugs on the collars rather than in front of them. The front part of the appliance could then be dressed away as necessary.

Sometimes when the incisor teeth of the maxillary arch are too prominent, they should not be moved inward until the teeth of the lateral maxillary divisions of the arch are forced backward to a normal occlusion in the process of equalizing, after which a labial semicircular spring should be attached for moving the four incisor teeth inward to take a good line with the canines which just previously had been moved backward in the line of the arch. With this plan the normal lateral occlusion of the teeth being first established, the maxillary anterior protrusion can then be more thoroughly reduced by moving the incisors inward.

For cases requiring the maxillary or mandibular incisors to be moved outward, finger springs are attached to the anchorage portion of the appliance, one on each side, extending forward in a curve to cause the necessary force, as shown in Fig. 17 or, a semicircular spring with U-shaped loops can be employed for this purpose, it being attached to the anchorage portions of the appliance.

For this and all purposes, the advantage of having regulating appliances biult in divisions, as the intermaxillary and the lateral maxillary division, will be readily understood.

Sustaining Bar.

In equalizing the dental arches antero-posteriorly, it is sometimes necessary to sustain the anchorage teeth in a manner that will keep them in an upright or perpendicular position, while force, as by rubber equalizing bands, is applied for moving forward or backward the maxillary or mandibular arches and during their retention.

For the purpose of sustaining the canines of the mandibular arch, a small tube a little shorter than the width of the collar, on the canine, as shown in Fig. 19, is soldered to the disto-buccal surface of the collar, usually in a perpendicular position, there being also a lug on the buccal surface of the collar shown at "A" used for anchorage.

A collar with a similar lug is cemented to each of the canines.

For sustaining the molar in an upright position, to the buccal surface of the collar, there is soldered a horizontal tube "G"; this is a little shorter than the antero-posterior measurement of the molar to support the end of the sustaining bar and to serve as a lug for the wire clasp "H" of the appliance.

Through the tube on the molar is passed a wire, usually No. 18 gauge, extending forward following the gum line to the canine, where it is bent into a small perpendicular loop, the end entering the tube on the collar from above downward. With the bar entering the tubes in this manner, it sustains the anchorage teeth as anterior or distal force is brought to bear on them. The bar is known as a sustaining bar. Any other teeth in the arch can be sustained in a similar manner. When it is desired to sustain the anchorage teeth of the maxillary arch, the same plan described would be employed. In either case the sustaining bar is not often necessary.

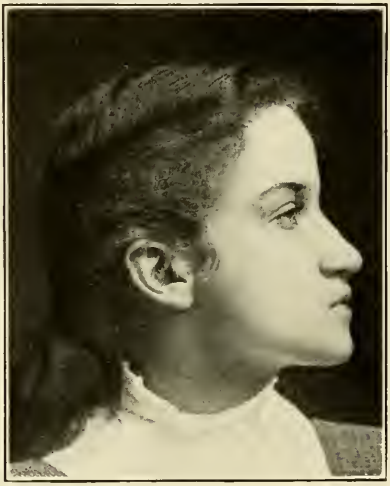

Fig. 20.

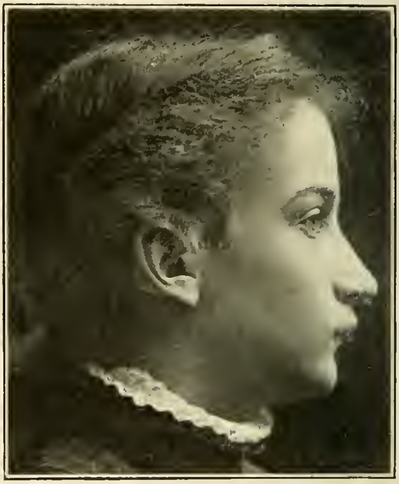

Fig. 21.

If the second molars are not sufficiently erupted for anchorage, the collars should be cemented to the first molars, but it is always advisable to have the anchorage of the distal part of the appliance as far back in the arch as is practicable.

The force of the rubber equalizing bands in equalizing the dental arches should be sufficient to cause the movement to be rather prompt, and it is well that the equalizing hooks in the plane of the maxillary and mandibular arches be not located too near together, that is, to have the hook for supporting the equalizing band to the mandibular arch and the hook to hold the band of the maxillary arch a considerable distance apart in order to stretch the equalizing band sufficiently to cause a proper amount of force; at the same time, by having the hooks further apart, the band would not interfere with the patient's opening the mouth, as in mastication, without causing much additional stretch of the equalizing bands.

When more force is necessary, a longer stretch of the equalizing bands can be attained by soldering another wire hook to the molar wire clasp to rest back of the lug on the collar.

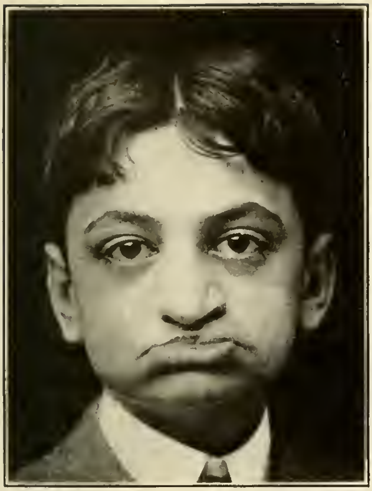

Fig. 22.

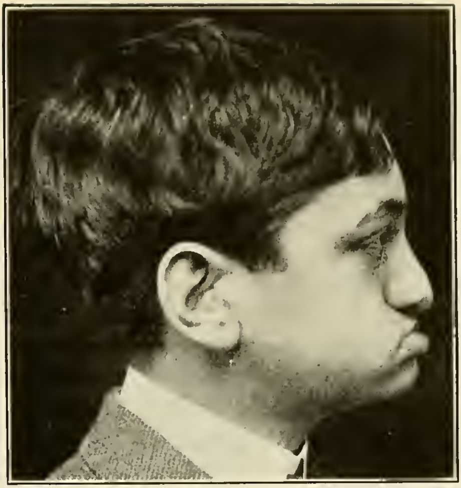

Fig. 23.

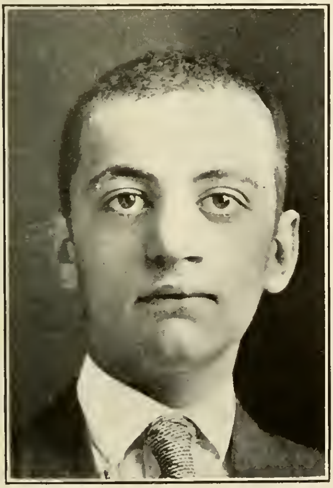

Fig. 24.

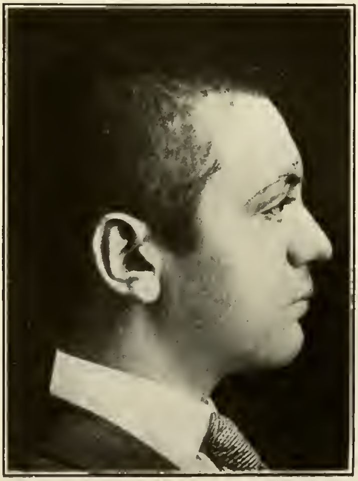

Fig. 25.

The hook is shaped and bound to the wire clasp by a piece of ribboned metal. The latter is prepared by rolling very thin a soft and small-sized bronze wire. After rolling, one side of the metal should be slightly tinned and wound twice or more around the parts to be joined with the tinned side in, then soldered so that the solder, when applied with flux, will follow the tinned surface of the metal, which would suck the solder in around the wires and make a strong joint. With this plan, the equalizing hook will be extended backward nearly the width of the molar.

Another plan of locating the equalizing hook further back in the arch is to shape a spring wire about No. 16 or 17 U. S. standard wire gauge to be attached to the lingual side of the appliance and to extend backward as far as desired, then bent in a curve to the buccal side of the arch, where an equalizing hook is attached to rest in line with the buccal side of the molars.

To increase the force of the equalizing bands before the permanent canines are erupted, it is sometimes advisable to attach a rigid wire extension to the front part of the apparatus. This is usually arranged to pass through the space caused by the loss of a deciduous canine or a deciduous molar to the buccal side and to extend forward as far as the lateral incisor and there have an equalizing hook attached. In this case, the front part of the appliance is to be retained to one of the teeth, as a premolar or a deciduous molar, by a locking device in the usual way. When not sufficiently well sustained in that manner, a collar with a suitable labial lug for its support should be cemented to the lateral incisor.

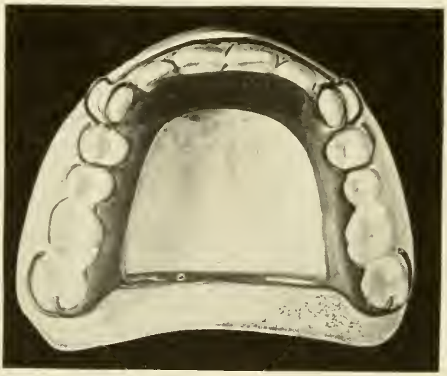

Fig. 26.

Occasionally, for anchorage, when several of the deciduous teeth in the front part of the arch are absent, equalizing hooks are attached to the loops of a semicircular spring that is arranged to pass in front of the incisors. This spring is retained by a collar with a labial lug, cemented to each of the lateral incisors. When this form of apparatus is used, generally a lingual semicircular spring is adjusted to prevent the incisors from being forced backward in the arch as labial equalizing force is applied. These extensions are applicable to each arch for causing greater force and are necessary in certain classes of cases.

As a greater or less force is often required, it is advisable to keep in stock equalizing bands of the same size but of different tensions.

In expanding the arch laterally, as previously described, or in moving the teeth too rapidly, they are liable to become tipped outward abnormally. This is often noticeable as in moving the canines laterally outward in providing more space for maxillary irregular incisors. The tipping can be easily prevented and the teeth moved bodily by the anchorage locking device described. A spur or shelf of plate metal, such as has been recommended, is attached to the lingual side of the collar used for anchorage at the gum line. The apparatus is made to rest on the lingual shelf, and the wire clasp extending from the apparatus is shaped to rest above the buccal lug on the collar as shown.

Fig. 9 and Fig. 16 A. By this arrangement, the appliance resting on the lingual shelf and wire clasp extending to the buccal side of the tooth and pulling on the lug, the canine is held in a perpendicular position as force is applied in moving it bodily outward. If at any time the canine is not sufficiently perpendicular, the end of the wire clasp can be made to pull harder on the buccal lug and so force the root more bodily outward, or the force can be gauged to give the canine the position desired.

In a similar manner, a premolar or a molar can be moved outward bodily, by having the appliance rest on the lingual shelf attached to the premolar or molar collar and the wire clasp shaped to extend from the appliance back of the molar to the buccal side to pull on the buccal lug provided. Added force is caused by bending from time to time the end of the wire clasp so that it may pull harder on the lug.

In equalizing the dental arches antero-posteriorly, when there is a considerable force on the mandibular molar caused by the stretch of the equalizing band pulling forward and upward on the lug of the collar. it sometimes tends to tip the crown of the molar inward and the apex of the root outward. When this occurs, it is readily prevented by soldering a lingual lug on the collar facing gingivally, and shaping the appliance to catch underneath the lug. At the same time, a wire clasp that extends from the appliance back of the molar is fitted to rest or press on the upper surface of a buccal lug provided for righting the position of the molar. When desired, as in equalizing the dental arches, the end of the clasp can terminate in an equalizing hook for holding an equalizing band.

For promptly tipping the tooth more upright, the buccal portion of the spring is bent downward to press more heavily on the buccal lug, while both this force and the force of the equalizing band is lifting upward on the lingual lug.

In such a case, the wire clasp would be made of larger wire than usual, to be sufficiently stiff promptly to cause the necessary force; the force being governed according to the desired amount of bodily movement of the root of the molar, so as to give it a more upright position.

The same principles of anchorage would apply in either of the cases described, and is applicable for causing the similar movement of any teeth in the arch.

When the molar wire clasp is properly adjusted for anchorage, the ordinary force in regulating seldom changes the position of the molar.

In further considering the subject of the equalizing of the dental arches, we shall examine the facial features of one or more cases and call attention to some necessary points in their diagnosis. In cases of maxillary protrusion, it is always advisable to examine carefully the facial line and determine whether the mandible is sufficiently prominent, or whether it should be made more prominent. (Fig. 20.) This is usually determined by the study of the profile facial line, by holding upright with the hand toward the patient, a small pencil or straight-edge, and sighting across it so that the line from the eye will rest on the forehead and, at the same time on the point of the chin, and from this determine whether the chin is sufficiently prominent or too prominent to compare with the line of the forehead and balance well with the features. In this case it was determined from examination that the mandible was practically prominent enough. In order to demonstrate this principle more fully, it is usually wise to ask the patient to move the mandible forward as much as would permit the mandibular teeth to interdigitate with the teeth of the maxillary arch as shown in Fig. 21, from which it will be seen by examining the changed facial line that both the mandible and the maxillary arch would be much too prominent. Therefore, for the correction of this condition, it requires more particularly the reduction of the prominence of the maxillary arch and, accordingly, in equalizing the arches in this case, the lateral maxillary divisions of the maxillary arch should first be moved backward sufficiently to occlude properly with the teeth of the mandibular arch. With our plan of equalizing the dental arches, this is easily accomplished, as all of the mandibular teeth would form an anchorage for moving backward in the line of the arch, a less number of teeth in the maxillary arch, as the molars, premolars and canines, until they rest in normal occlusion with the teeth of the mandibular arch. The prominent maxillary incisors should then be moved inward to occlude properly with the mandibular incisors by attaching a semicircular spring with loops to the apparatus for the purpose, thus reducing the prominence of the maxillary arch. The intermaxillary force employed should be continued to counteract the force of the labial springs in moving the incisors inward.

There is a vast variety of neglected cases that should be treated by the orthodontist. He is sometimes called upon to meet extreme conditions. Figs. 22 and 23 illustrate an important example of a trying case. By studied treatment, marked improvement was brought about in the facial lines and in the occlusion, as shown by Figs. 24 and 25.

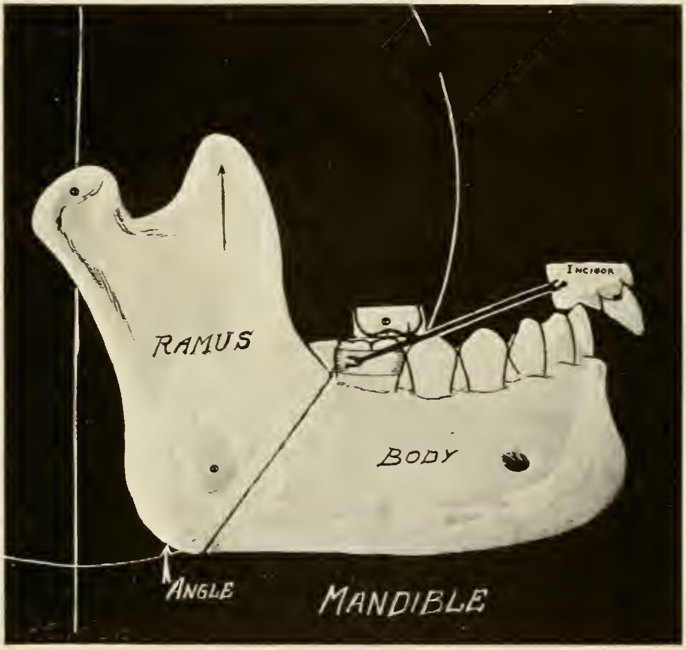

FIG. 27.

Changes in the Mandible.

In equalizing the dental arches, antero-posteriorly to any extent, there are always changes taking place in the shape of the mandible, principally at the location of the angle, caused by the necessary intermaxillary force.

It is essential that all details of this movement and changes caused by equalizing the arches be understood by the orthodontist. It is important to him in the diagnosis, the laying out of a general plan of treatment and indicating in the different stages the best method to pursue; as an example, when the mandibular arch has distal occlusion, with the incisors antagonizing with the gum just back of the maxillary incisors, or a case with moderate distal occlusion. This condition has been successfully treated by utilizing the normal occlusal force in depressing the lower incisors and, at the same time, changing the shape of the mandible by adding to an upper regulating appliance a metal shelf attached to the arms of the appliance. The shelf is shaped to fit the lingual curve of the incisors and project backward enough so that the lower incisors, when in occlusion, would rest upon the shelf, not permitting the molars and premolars to occlude.

In such a case, the appliance should be well anchored and supported to resist the force in mastication. (Fig. 26.) For the latter, a looped spring wire should be shaped to pass around the tapered cusp of each of the upper canines, and rest near the mesial and distal surfaces, with the ends of the wires extending toward the gum passing underneath the shelf to which they are soldered. With this arrangement, the shelf is strongly supported and, when the appliance is kept constantly in place, would gradually change the angle of the mandible through the force caused by the action of the mandible in attempted mastication with the six mandibular anterior teeth resting on the shelf in occlusion, with none of the other teeth occluding. The shelf is sometimes made level, but when the arches need equalizing, it is tipped forward more or less so that, when the mandibular incisors rest upon the incline of the shelf, they would slide forward drawing forward on the mandibular arch. In

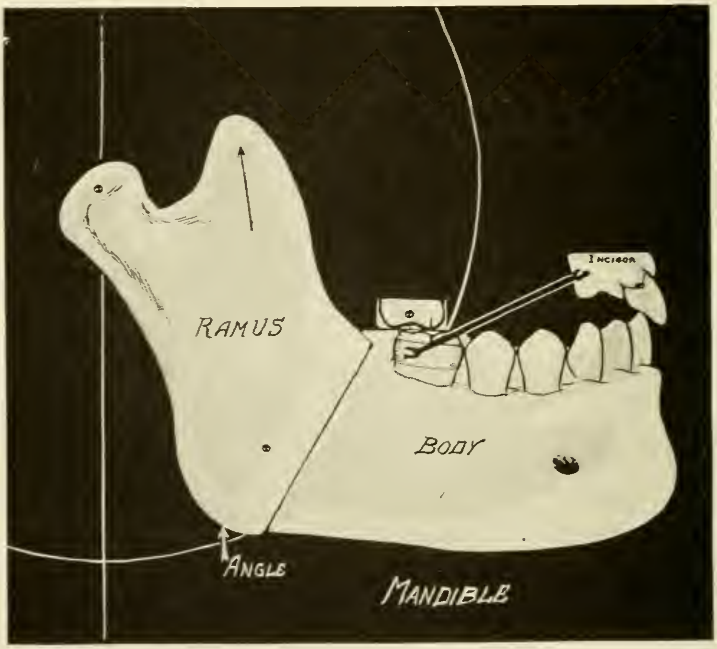

Fig. 28.

occlusion this force, in effect, downward and forward on the anterior part of the body of the mandible gradually causes the angle of the mandible to become more obtuse and the body of the mandible to move farther forward, thereby tending toward normal occlusion.

This change in the angle will be better understood by reviewing the plan of the development of the mandible and later by its treatment. With the young child the ramus is short and the body of the mandible is short. The body of the mandible in its further development gradually becomes longer from the symphysis to the ramus to accommodate each developing deciduous tooth in its regular order of eruption and continues its development to accommodate each of the erupting permanent teeth in their successive order. The eruption of the third molar seldom occurs before the age of 18 to 21 years. During this time the ramus portion of the mandible is undergoing a similar progressive development at the angle, contributing to the length of the body and ramus. By this it will be understood that the region at the angle of the mandible is in a constant developmental stage from the beginning of the life of the child to that of the adult, and accordingly, its cellular arrangement during this period is more easily changed by any steady, constant force.

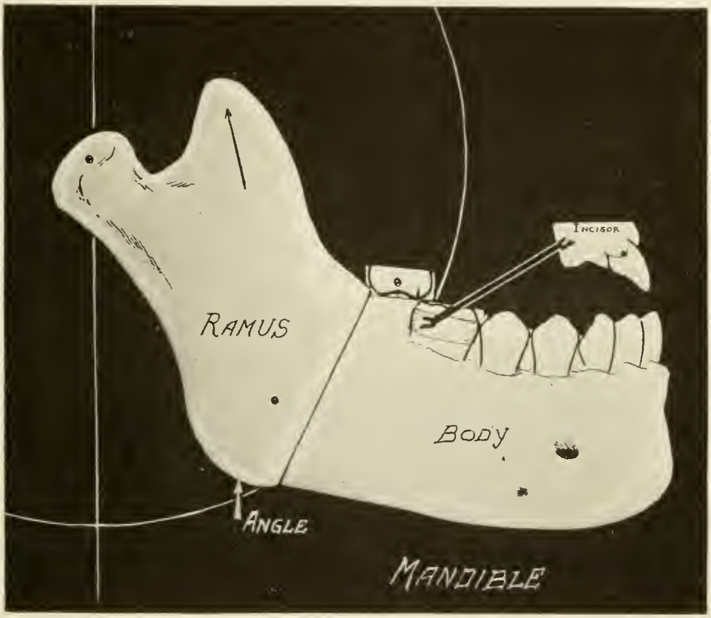

Fig. 29.

The anatomical changes in the mandible from infancy to old age must always be kept in mind in our diagnosis. The angle of the ramus and body of the mandible in infancy is obtuse and through normal development of the body and the ramus it gradually becomes more nearly a right angle about the adult period or later, but as one advances in life, the angle of the mandible again becomes more obtuse.

Fig. 27. In continuing, cases with more defined distal occlusion require in their correction intermaxillary force for the equalizing of the dental arches by the use of rubber equalizing bands. As stated, in bringing about normal occlusion, one should fully understand the changes that are to take place in the form of the mandible. In masticating, the normal movement of the angle of the ramus portion of the mandible backward and forward describes a section of a circle. When the mouth is opened, the angle of the ramus approaches the lowest point of the circle and, when the mouth is closing, the angle of the ramus moves forward in the circle to a higher level. The continued equalizing force in moving the teeth forward to correct the distal occlusion gradually bends and raises the distal part of the body of the mandible and molar teeth upward to a higher level in relation to the incisor teeth which generally antagonize with the gum back of the maxillary incisors, in effect, bending the forward part of the body of the mandible downward. As this is done, the mandibular molars are caused to occlude further forward to a normal position in relation to the maxillary molars by the ramus becoming more obtuse; also the mandibular incisors are brought to a lower plane to occlude normally with the maxillary incisors (Fig. 28). This is caused by the lower end of the ramus with the body of the mandible being drawn forward by the force of the equalizing bands attached to the apparatus opposite the maxillary canines and to the distal mandibular molars, the force of which bends the mandible at the angle, thus causing the ramus to take a more obtuse angle in its relation to the body of the mandible.

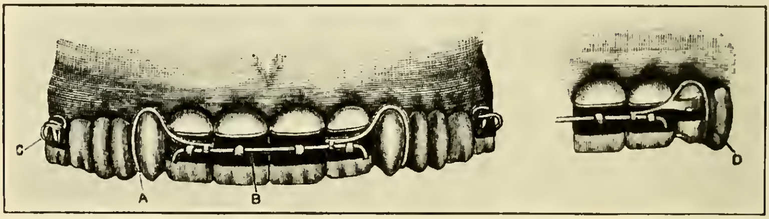

Fig. 30.

Through these changes, the ramus retains the same normal temporomandibular articulation through the normal action or strain of the muscles and ligaments, while the lower end of the ramus that joins the body of the mandible, swings forward and upward in the circle as in the act of mastication. The circle that it describes represents the length of the ramus from its articulation to the angle where it joins the body of the mandible. As the lower end of the ramus at the location of the angle is drawn forward by the force on the teeth in equalizing the arches, it will be noted that it swings the lower end of the ramus in the line of the circle; this raises the body to a higher level and the farther the teeth and body of the mandible are moved forward by this force, the more the mandible is bent at the angle.

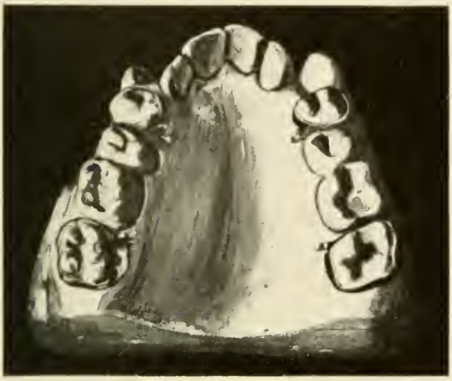

Fig. 31.

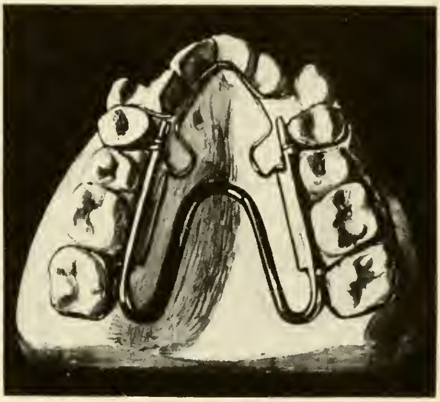

Fig. 32.

In equalizing the dental arches antero-posteriorly, it sometimes occurs that the continued force in equalizing would cause the angle of the mandible to become too obtuse, resulting in the front part of the body of the mandible being bent downward more than it should be, often causing lack of anterior occlusion of the teeth, and at the same time if the force be further continued, it would cause the body of the mandible to move forward too far, tending toward a prognathus condition. (Fig. 29.)

This generally results from a mistake in diagnosis and treatment, as the body of the mandible should not be moved forward in any case during the process of equalizing more than to gain a normal occlusion and a good profile. In equalizing, if lack of anterior occlusion of the teeth is taking place, the equalizing should be discontinued and the mandibular arch sustained, while the teeth of the maxillary arch should be forced backward more to bring about the desired normal occlusion.

In cases when there is a moderate lack of anterior occlusion, the teeth can be readily elevated for its correction by cementing a collar with a labial hook to each of the teeth exhibiting lack of occlusion and extending a wire finger spring from the appliance, usually at the junction of the first premolar and canine to the buccal side of the arch, shaped to follow forward in the curve of the arch to rest in the hooks on the collars provided. The spring should be bent downward from time to time for the purpose of elevating the teeth as desired. (See Fig. 30.)

For additional force, a collar with a hook-shaped spur pointing downward can be cemented to one or more of the mandibular incisors or the canines and an equalizing band of small diameter be applied to the hooks arranged in the maxillary and mandibular arches, or the band be passed over the spring extending from the appliance and stretched to the hooks of the opposite arch. When the arches have been equalized and the front teeth elevated, they generally require long retention.

In the correction of lack of anterior occlusion of the dental arches, which generally improves the appearance, it should first be determined from the action of the patient's lips, when smiling, whether the maxillary or the mandibular teeth with their sockets should be elevated. A method that has been common in practice with the writer for a considerable number of years in elevating the teeth for lack of occlusion, as of four incisors, and at times including the canines and, when necessary, the premolars and molars, is to cement a collar with a labial hook to each of the teeth to be elevated. For the mandibular arch, the hooks should point downward, and for the maxillary arch, they should point upward.

The hooks are made of plate metal and the ends made long enough to bend around a labial bar. (Fig. 30.) The bar of 19 or 20 gauge is curved and rests in the hooks provided, and the hooks are made long enough to be bent around the bar to clasp it when in place. An appliance with a palatine base wire strongly anchored, as described, has a spring wire arm extending from the appliance over the arch at the junction of the canine and premolar and extends forward on the labial side close to the teeth near the gum where the arm terminates in a side bend to hook over the bar and back of it, between the central and lateral incisor, one arm on each side of the arch. The arms are to be bent downward or upward a little at a time once a week as required for the elevation of the teeth. The appliance is readily removed by unhooking the springs from the bar. This is convenient both for the patient and the operator. The plan is especially suited for moving the teeth and for their long retention. An appliance of a similar plan is utilized for the depression of incisors.

Cases of true prognathism accompanied with lack of anterior occlusion can usually be corrected by the uninterrupted application of external force on the mandible over the mental process at the symphysis by the use of a chin cap and cranial cap, causing the ramus to become less obtuse, permitting the body of the mandible to bend upward with the incisors, bringing about normal occlusion.

Special Form of Removable Appliance.

The appliance to be described is arranged for the treatment of a case with narrow maxillary arch with prominent canines, the lateral incisors now resting near the first premolars, requiring the general expansion of the arch for the full accommodation of the canines and establishment of good occlusion.

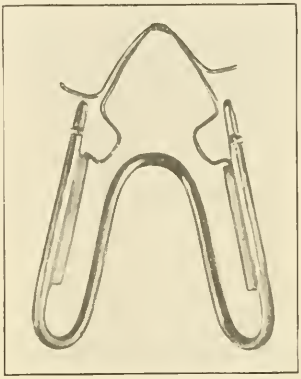

Fig. 33.

For anchorage, Fig. 31, there is soldered to a collar a U-shaped piece of plate metal or a small loop of wire about No. 16 with two short projecting arms or spurs extending lingually, one above the other. One arm is slightly longer than the other to act as a shelf for sustaining the base wire of the appliance, the shorter one holding it in position.

These spurs, often in the form of a wire loop, are generally attached to the lingual side of a collar cemented to each of the anchorage teeth, usually the first premolar and distal molar on each side of the arch, the loops in this case being attached to the collar rather near the junction of the teeth to permit the base wire of the appliance, when in place, to rest on the surface of the collar and side of the anchorage teeth.

Fig. 32. With an appliance anchored in this manner, tubes for supporting springs for moving individual teeth can be attached to any part of the base wire, or the springs be soldered directly to the base wire. The appliance can be easily removed for making necessary changes and is readily readjusted.

With the appliance illustrated, a tube is soldered to each arm of the base wire for sustaining the ends of the lingual semi-circular spring with U-shaped loops. To the semi-circular spring back of the central incisors at the median line is soldered a small additional curved spring with the ends projecting like arms resting on the lingual side of the central incisors and laterals with the ends terminating on the distal surface of the latter. The free ends of the spring or arms are bent outward from time to time for moving the laterals outward and forward, while all of the incisors are forced forward as desired by opening the loops of the semi-circular spring. At the same time, the arch is being expanded laterally by opening the loop of the base wire.

Fig. 33 outlines the full plan of the appliance. It is readily removed from the teeth by grasping one arm opposite the second premolar and forcing it lingually a little to unlock it from the spurs on the collars described. As the appliance is removed, the semicircular spring can be withdrawn from the tubes to permit any necessary change of form of the spring or of the base wire. The appliance is readily readjusted to the teeth by placing one of the arms of the base wire into the U-shaped supports on one side of the arch, pressing in that direction on the other arm of the appliance to lock it in the U-shaped supports on the other side of the arch.

Another Form of Anchoring Appliance.

A desirable plan of anchoring a removable appliance with tubes or eyelets on collars cemented to anchorage teeth, having any form of base wire to which springs may be attached is given below.*

"When one is accustomed to the use of collars for anchorage, this system is utilized by anchoring a base wire as follows: A collar, with a tube soldered on the lingual side, is cemented to a distal molar and to one of the bicuspids on each side of the arch. The tubes can be arranged on the collar at any angle varying from the horizontal to the perpendicular. A heavy lingual or palatine base wire is held in place by soldering to it a small, strong wire in position to enter the tubes. Wires entering the tubes on the molars are sometimes arranged to hook into the tubes from the distal end, while similar wires are attached to the base wires to enter either horizontal or perpendicular tubes on the bicuspids. When tubes are arranged perpendicularly on the collars, they are generally inclined a little either forward or backward to improve the anchorage, so that when force is applied, the apparatus will not become dislodged. A labio-buccal base wire is anchored in a similar manner. When desirable, all of the tubes can be arranged perpendicularly. The anchorage teeth are prevented from rotating, when extreme stress is put upon them, by soldering the tubes on the mesio-lingual or the disto-lingual surface of the collar, according to the strain to be applied."

The author has endeavored to present in this paper the more important principles of his system of orthodontia and trusts that the suggestions may be of permanent value.

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*Jackson's Orthodontia, page 88.

Indications and Contra-Indications for the Extraction of Teeth for the Purpose of Correcting Malocclusion.

By Dr. Martin Dewey, Chicago, Ill.

Read Before the American Society of Orthodontists at Chicago, Ill., Apr., 1920

The question of extraction for the correction of malocclusion has always been a point of conflict between various men in the practice of orthodontics. According to the title of this paper we are willing to admit that there are indications and contra-indications for the extraction of teeth, and will endeavor to give you a few examples which will, to a certain extent, tend to illustrate what we mean by the above title.

Contra-Indications for Extraction.

We can say that the contra-indications for extraction greatly outnumber the indications of extraction for the correction of malocclusion. Various types of malocclusion have been described as indicating and demanding extraction, and in some instances the reasons for these extractions have been based upon the diagnosis of the case as described by the writer. Therefore, some of the disputed questions in regard to extraction have been waged around the diagnostic point in regard to the type of malocclusion that is present, and in some instances writers who have advocated extraction and non-extraction have not been so far apart as at first we imagined. The old argument that extraction should never be resorted to in any case may be considered as being too broad a statement, because there are certain etiological and pathological factors present in some types of malocclusion in which a more serviceable result can be rendered to the patient by the extraction of one or more teeth. The question of extraction, however, in these cases is decided upon etiological and pathological factors, the age of the patient, and the condition of the tissue surrounding the teeth, which means that other factors must be considered than the mere "class of malocclusion" as you recognize it according to the classification of the mesio-distal relation of the arches as adopted by this society.

Probably the two greatest advocates for extraction in the correction of malocclusion today, judging from their writings, are Dr. Calvin C. Case of this city, and Dr. Edward Canning of Denver, Colorado. It is my belief that in the majority of the cases which these two writers cite in their textbooks as indicating extraction are cases in which extraction is contra-indicated. In Chapter 14 of Dr. Case's *Principles of Dental Orthopedia*, published in 1908, he reviews the *Symposium on Extraction of Teeth,* which was held by the Second District Dental Society of the State of New York in February, 1905, and also refers to a paper by him published in *The Dental Cosmos* for April and May, 1906. In this chapter he particularly calls attention to cases characterized by protrusion of the upper or retrusion of the lower teeth as demanding or not demanding the extraction of the teeth. He shows cases of "retrusion of the lower with slight protrusion of the upper," in which he states extraction is not demanded. The other cases, which he characterizes as "protrusion of the upper with lower normal" and "protrusion of the upper with retrusion of the lower," and also "upper protrusion with retrusion of the lower jaw and teeth" are cases in which he desires extraction. In this chapter, he states that he has selected six typical cases which demand correction without extraction, and twelve which demand extraction of the first or second premolars for their perfect correction, and "it is about in that proportion in this character of occlusion that the two methods of treatment, non-extraction and extraction, are respectively demanded." All of these cases which he has referred to are cases which the majority of this society would classify as distoclusion, or cases where the lower arch has a posterior relation to the upper. In the majority of these, Dr. Case contends, as does Dr. Canning, that the upper arch is the one that is at fault, and we have protrusion of the upper with normal lower, or only a relative degree of posterior relation to the lower arch.

So, in the beginning, it is impossible for the writer to agree with Drs. Case and Canning upon the diagnosis of these conditions, and of these cases which Dr. Case describes in Chapter 14, of which he says six should be treated without extraction and twelve with extraction, the essayist will say that extraction is contra-indicated in all of these cases. As a result of this, I will further state that there is no type of malocclusion based upon anterior or posterior or mesio-distal arch relations in which one can say that extraction is demanded in all of a certain group. There are undoubtedly a few cases of mesioclusion in which the length of treatment can be shortened to a great extent by the extraction of one of the premolars. Mesioclusion cases in which we find a decided bunching of the lower incisors, or cases with labioversion of the lower teeth in relation to the upper in which it is the intention to retract the six anterior mandibular teeth bodily, may be advantageously treated by extracting a mandibular premolar. However, this class of cases is extremely rare, and in my practice has never been encountered.

Another condition which has been mentioned by Dr. Case and Dr. Canning is what is termed "bimaxillary protrusion," in which they contend the teeth in both the maxillary and mandibular arch have taken an anterior position in respect to the face. I am willing to admit that if such a case ever existed extraction of the four premolars would be justified, but in my practice I have never seen it. Dr. Case has described these conditions for a number of years, and I sincerely hoped that when I came to Chicago, I would be fortunate enough to find such a case, as I was never able to find them in communities where I have practiced heretofore. I am willing to admit, for argument's sake, that if bimaxillary protrusion existed, extraction would be justified, but I have never seen a case.

Extraction Indicated.

Another type of cases in which extraction is indicated are in mesioclusion cases with impacted lower third molars. In some mesioclusion cases it may be advisable to extract the second molar and allow the third to take the position of the second, but nevertheless this is a pathological condition which makes extraction necessary, and the extraction is not performed because it is a mesioclusion case.

We find extraction of third molars indicated in neutroclusion cases where an eruption of the third molar is producing a bunching of the anterior teeth. Also in those cases where the third molar has become impacted, and is producing an elongation of the second molar with the result that the bite is being opened. Therefore in the treatment of malocclusion extraction of the third molar is indicated (1) in neutroclusion cases where the eruption is producing bunching in the incisors, or (2) superversion in the molar region which is producing an open bite in the incisors.

We also find another type of neutroclusion conditions, in which there is a superversion of the first permanent molars produced by the eruption of the second molars that has resulted in an open bite condition and the lengthening of the face from the nose to the chin, in which case also extraction of the first molars is indicated in those cases for the purpose of closing the bite and producing a proper length of the face.

Another pathological factor which will have an influence on extraction is that of devitalized and diseased teeth. If a patient present with one or more teeth badly diseased and in the light of modern knowledge we know the tooth can be retained but a short time without being a detriment to the patient, then the extraction of that diseased tooth is indicated and a compromise treatment followed such as has been suggested by various members of this society during the last few years.

Another indication for extraction is found in mutilated cases where a tooth has been taken out of one arch and the case is treated with the idea of a compromise treatment to produce harmony in the size of the two arches by extracting the corresponding tooth in the opposite arch and allowing or causing the space to close. While these compromise treatments will not produce normal occlusion, it is the belief of the writer that they will shorten the time of treatment and furnish the patient with a more effective dental apparatus than would be obtained if the spaces had been maintained and artificial teeth substituted.

Extraction may also be indicated in conjunction with missing teeth and the treatment based upon the same lines as suggested in those cases where we have mutilated arches or have been forced to extract because of pathological involvements of the diseased teeth. However, in those cases in which teeth are missing, it must be remembered that you have the two types of compromise treatment; that is, first, endeavoring to close the space in one arch and leaving the normal number of teeth in the opposing arch; or, second, the extraction of one tooth in the normal arch so as to have the same number of teeth present in both lateral halves

In the presence of supernumerary teeth, the extraction of the supernumerary tooth is the general procedure, but in some instances we find the supernumerary tooth has assumed a much better position than the normal tooth, and the supernumerary has also such a good shape that the length of treatment may be shortened by extracting the normal tooth and leaving the supernumerary in position.

Another condition which has a bearing upon the indication for extraction is the age of the patient. The patient receives orthodontic treatment with the idea of improving the malocclusion, so as to provide him with a more efficient masticating apparatus, or to correct facial deformities. We find in older patients that the condition of the supporting structures are such, that an extensive movement of malposed teeth is not indicated and then extraction may be resorted to, as the most feasible way to supply an improved occlusion, and also shorten the time of treatment. The age of the patient, the condition of the tissue and the length of treatment are factors which may decide in favor of extraction in any of the three classes of arch relation for the purpose of producing a compromise treatment for that individual which will be efficient. In those cases we work for the purpose of improving the masticating efficiency of the teeth as being more important than ideal results, the obtaining of which is questionable owing to the condition of the patient and other factors we have mentioned.

We find the age of the patient will also be a contributing factor in regard to the type of treatment indicated, especially in those cases where the loss of the upper or lower deciduous molars has allowed a drifting forward of the permanent molar so as to produce an abnormal locking of the molar region in one or both sides. Where the upper molar has drifted forward, these cases have erroneously been classified as unilateral distoclusion, but according to the proper classification as suggested by Lischer they should be classified as "neutroclusion with mesioversion of the upper molar." Cases of the age of seven or eight should be treated by moving the upper molar back to its normal anterior posterior relation, developing the arches, so as to allow all the permanent teeth to assume their position, and thereby establishing a normal occlusion of all the teeth. Cases more advanced in age after all of the permanent molars have erupted, and all of them have taken an anterior relation to the lower molars, offer opportunity for treatment by extraction. The upper canine and first premolar occupy the normal mesiodistal relation to the lower, therefore such a case is "one of neutroclusion with mesioversion of the molars."

The second premolar is always impacted, and if removed greatly shortens the time of treatment and gives the patient a serviceable masticating apparatus. These cases offer two plans of treatment possible. First, that of moving back or posterially the three permanent molars which would be a long procedure. The second, and much shorter plan and I believe the wisest plan from the standpoint of time and efficiency, would be the extraction of the impacted premolar, permitting the maxillary molars to occupy their mesial position.

The question of the age of the patient, and not the type of malocclusion, would be the deciding factor between these two plans. In all cases of extraction in the treatment of malocclusion, etiological factors are the greatest deciding point and not the type of malocclusion.

Discussion of Dr. Dewey's Paper.

Dr. Varney E. Barnes, Cleveland, Ohio.

The setting up of rules indicating and contra-indicating extractions for the purpose of correcting malocclusions is a very dangerous procedure, particularly as a means of teaching young or old students of orthodontia.

Accenting what Dr. Pullen has remarked, there cannot be extraction for the purpose of correcting malocclusions, except in case of supernumerary or very deformed teeth that interfere with the placement of other teeth. Barring these exceptions, the extraction of teeth is a compromise treatment of a deformity, not a method of correction.

The essayist's rules and suggestions for extraction are in the main to be condemned, since he has not shown full X-rays indicating (1) soundness of all teeth; (2) the proper placement of roots of adjacent teeth and (3) presence or absence of all teeth. Every time a tooth is extracted, whatever the necessity, the operator should be on the defensive. He should consider the effects of extraction from all angles possible at the time, and his defense, to be free from just criticism, should be well nigh perfect.

The advising of extraction in many of the cases outlined seems like snap instead of sound judgment. In nearly or all cases, it should seem advisable to first try the teeth under orthodontic stress, to determine something of the possibilities in each particular case. Then, if undue resistance is met, extraction might be proven a lesser evil, not a correction.

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